WATER RESOURCES REPORT 22

STORAGE REQUIREMENTS

TO AUGMENT LOW FLOWS OF MISSOURI STREAMS

BY JOHN SKELTON

with a section on

SEEPAGE LOSSES

by JAMES H. WILLIAMS

GEOLOGICAL SURVEY AND WATER RESOURCES

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by

John Skelton,

Water Resources Division, U.S.G.S.

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Missouri Geological Survey and Water Resources

Prepared in cooperation

with

MISSOURI GEOLOGICAL SURVEY AND WATER RESOURCES

Rolla, Missouri

May 1968

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STORAGE REQUIREMENTS TO AUGMENT LOW FLOWS OF MISSOURI STREAMS

by

John Skelton

ABSTRACT

This report presents storage requirements for selected draft rates at 226 continuous-record and partial-record stations throughout the state. Regional draft-storage curves based on drought with recurrence interval of 20 years are presented for use in estimating storage requirements at ungaged sites. The draft rates selected are limited to those which can be maintained by storage which will be replenished each year.

Reservoir losses from evaporation, sedimentation, and seepage vary within and among physiographic regions. Methods of adjusting storage requirements for evaporation and sedimentation losses and guides for locating areas with potentially large seepage losses are presented.

INTRODUCTION

Future industrial, municipal, and agricultural growth and development in Missouri depend to a great extent on the conservation and intelligent utilization of the State's considerable surface water resources. If Missouri is to obtain optimum benefit from these resources, information concerning the storage of streamflow for release in time of drought should be available.

The purpose of this report is (1) to present storage requirements for selected draft rates at stream gaging stations on unregulated streams, (2) to present methods of determining storage requirements at ungaged sites on unregulated streams, and (3) to alert the reader to the effect of reservoir losses and provide a means of obtaining rough estimates of the general magnitude of these losses in study areas.

The information in the report provides processed data to the designer for his more complete analysis and should be considered as a guide to the approximate amount of controlled flow available from storage which will be replenished each year. Higher draft rates can be obtained by utilizing excessive annual flows in years of deficient flow; these higher draft rates were not studied for this report.

Draft-storage relations presented in the report are useful primarily in making preliminary estimates of potential development and in comparing the development possibilities of different streams. However, these estimates will often be adequate for the final design of small, multipurpose reservoirs in Missouri.

Acknowledgments

The information contained in this report is based on the low-flow frequency data presented in "Low-flow characteristics of Missouri streams" (Water Resources Report 20) by Skelton (1966). The work was performed in the Missouri district of the Water Resources Division, under the direction of Anthony Homyk, Jr., District Chief, and the report was prepared in cooperation with the Missouri Geological Survey and Water Resources, William C. Hayes, State Geologist and Director.

Definition of Terms and Conversion of Units

1. Acre-foot.-- A unit for measuring the volume of water required to cover 1 acre to a depth of 1 foot.

   1 acre-foot = 43,560 cubic feet = 325,851 gallons

2. Base flow.-- That portion of the stream discharge which is derived from ground-water outflow.
3. Climatic year.-- The 12-month period, April 1 to March 31. The climatic year is designated by the calendar year in which it begins and is used as the annual time unit for the analysis of low-flow data because it does not separate the annual low-flow seasons.
4. Continuous-record station.-- A particular site on a stream where continuous records of discharge are obtained.
5. Cubic feet per second (cfs).-- The unit expressing rate of discharge. One cfs is the rate of discharge of a stream having a cross-sectional area of 1 square foot and an average velocity of 1 foot per second.

   1 cfs = 7.48 U. S. gallons per second
   = 449 U. S. gallons per minute
   = 0.646 millions of U. S. gallons per day

6. Cfs-day.-- The volume of water represented by a flow of 1 cubic foot per second for 24 hours.

   1 cfs-day = 1.983 acre-feet
   = 86,400 cubic feet
   = 646,317 gallons

7. Cubic feet per second per square mile (cfsm).-- The average number of cubic feet of water flowing per second from each square mile of area drained, assuming that the runoff is distributed uniformly with regard to time and area. Cfsm is computed by dividing the discharge in cfs by the drainage area in square miles. It is a useful unit for comparing the discharges of streams draining basins of different sizes because it reduces, in effect, all basins to the same size. It should be used with caution in the Ozarks region because low-flow yields may differ widely within the same basin.
8. Isopleth.-- A line on a map connecting points at which a given variable has a specified constant value.
9. Partial-record station.-- A particular site on a stream where occasional discharge measurements are collected systematically over a period of years.

10. Recurrence interval.-- The average length of the interval in years between occurrences requiring storages equal to or more than that indicated by the data. Recurrence intervals are averages and do not imply regularity of occurrence; an event of 10-year recurrence interval might be exceeded in consecutive years or it might not be exceeded in a 20-year period.
11. 7-day Q_2.-- The median of the annual minimum 7-day average discharges. There is a 50 percent chance in any year that the annual minimum 7-day discharge will equal or exceed the 7-day Q_2.
12. Water year.-- The 12-month period October 1 to September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ended September 30, 1965, is called the 1965 water year.
13. Within-year storage.-- That storage which will be replenished each year by the high flow of the stream for release during succeeding low flow periods. Uniform draft rates less than the minimum annual mean flow are used in computations of within-year storage requirements.

METHOD OF ANALYSIS

All draft-storage requirements presented in this report are based on within-year storage analyses using the frequency-mass-curve method described by Riggs (written communication). This method of analysis involves the use of selected draft rates that are smaller than the maximum ones that can be developed but gives more accurate estimates of storage requirements than can be obtained with an over-year analysis.

The procedures used in computing storage requirements at continuous-record and partial-record stations and at ungaged sites are described in subsequent sections.

Storage-draft-frequency data for all continuous-record and partial-record stations where estimates were possible are presented in the appendix to this report. Selected draft rates and storage requirements at these sites for a drought of 20-year recurrence interval are shown in Plate 1.

Long-Time Streamflow Records

For long-time continuous-record stations, low-flow frequency data presented in a previous report (Skelton, 1966) were used in the analysis. Discharge data from low-flow frequency curves (Figure 1) for 7, 14, 30, 60, 90, 183, and 274 consecutive days at selected recurrence intervals were used in drawing the frequency-mass curve (Figure 2). For example, the volume of discharge for the 183-day period on the curve of Figure 2 (4,000 cfs-days) was obtained from Figure 1 by multiplying the 183-day discharge for the 20-year recurrence interval (22 cfs) by 183 days. Similar computations for other periods of consecutive days provided data needed to define the frequency-mass curve.

From the frequency-mass curves for each station, storages needed to maintain four or five selected draft rates were scaled. The maximum draft rate selected was somewhat less than the smallest annual mean discharge of record at the station.

The draft-storage-frequency curves (Figure 3) for selected recurrence intervals were then plotted for each station using draft and storage data extracted from the frequency mass curves. The recurrence intervals selected were based on length of streamflow record, i.e., larger recurrence intervals were shown for a station with 40 years of record than for one with 20 years

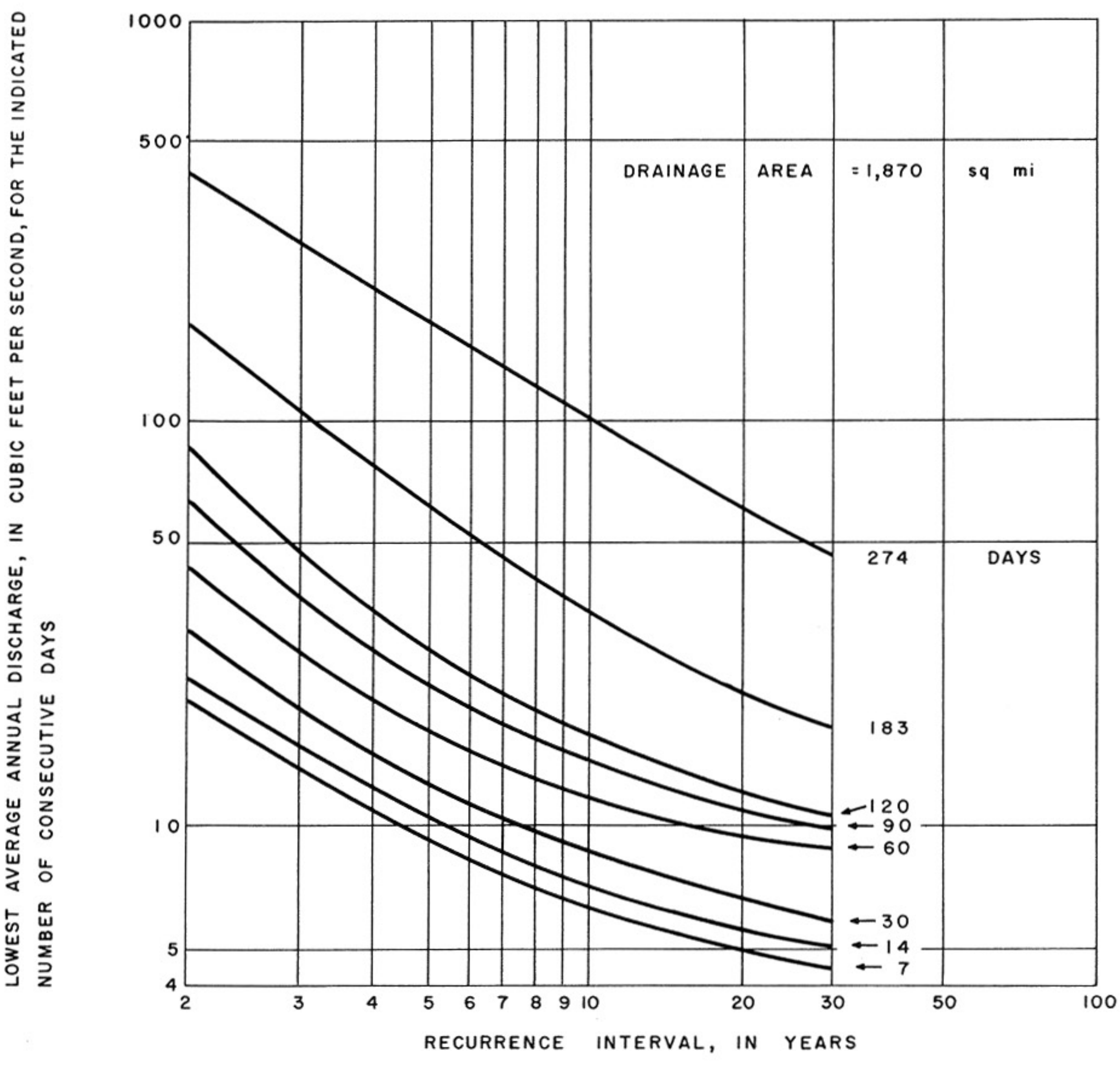


Fig. 1. Low-flow frequency curves, Chariton River near Prairie Hill, Missouri.

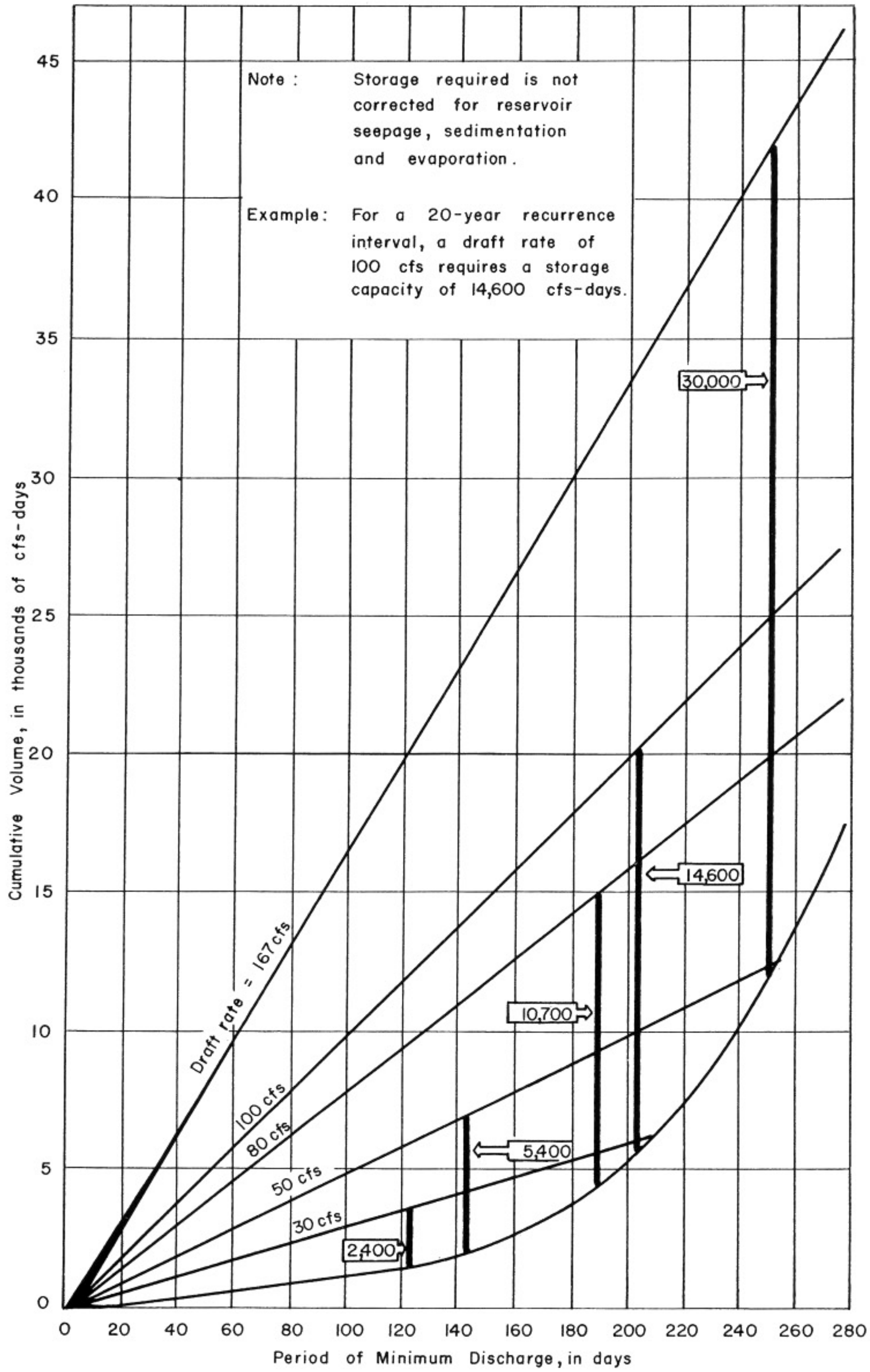


Fig. 2. Frequency-mass curve (20-year recurrence interval) for Chariton River near Prairie Hill, Missouri, showing method of defining storage required to maintain a given draft rate.

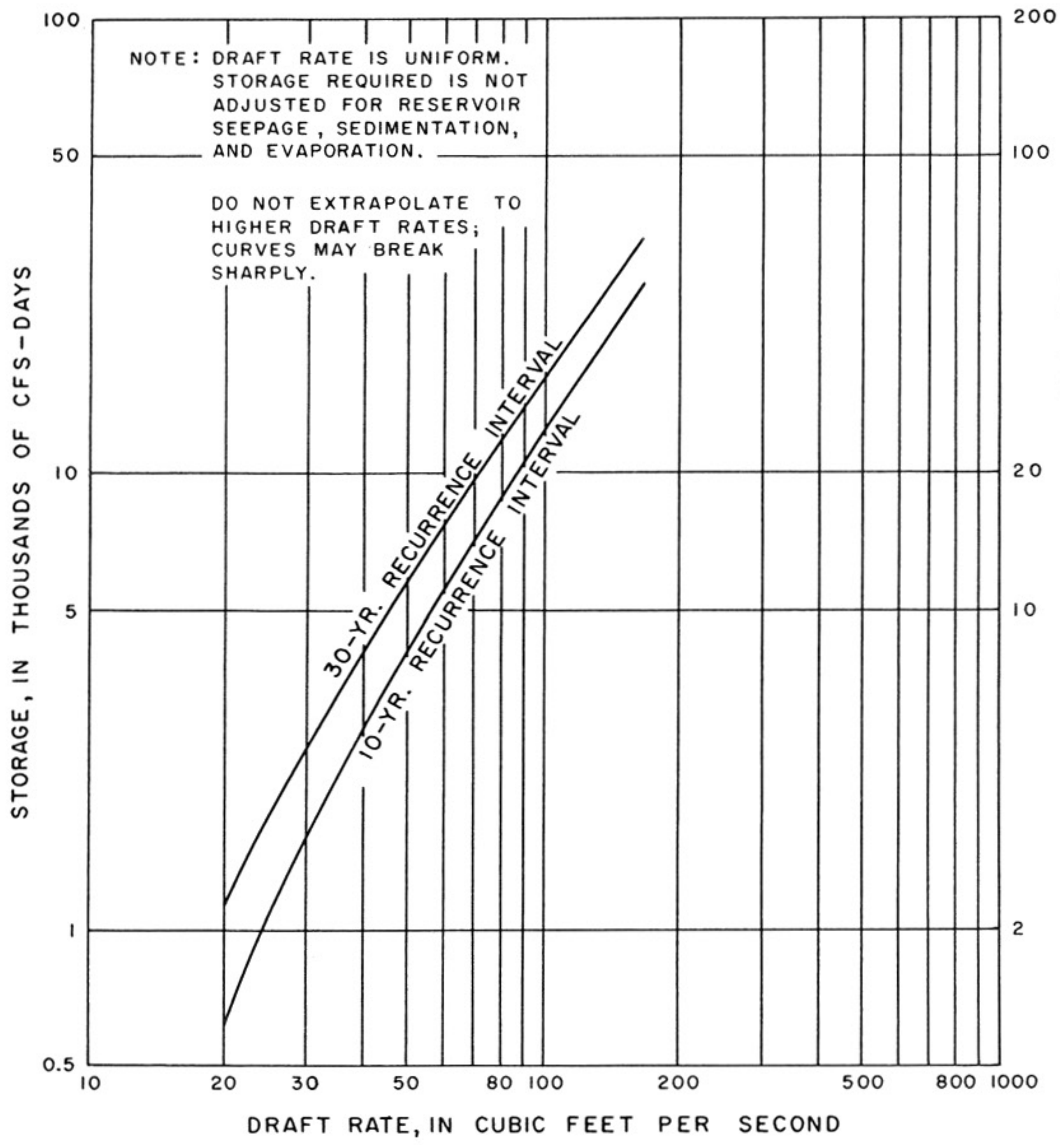


Fig. 3. Draft-storage-frequency curves, Chariton River near Prairie Hill, Missouri

of record.

From the draft-storage frequency curves, draft rates and corresponding storage requirements were selected for inclusion in the appendix to the report. For convenience, the storages given in the appendix are in units of acre-feet rather than cfs-days.

For a more complete description of the frequency-mass-curve method, see Martin and Hulme (1957) and Stall (1962).

Regional Draft-Storage Analysis

Development of regional draft-storage curves.-- To obtain estimates of storage requirements at partial-record stations and ungaged sites, regional draft-storage curves based on a drought of 20-year recurrence interval were developed from data computed for continuous-record stations throughout the state.

The first step in the procedure was reduction of draft and storage units of the relations at continuous-record stations to rates and volumes per square mile. In addition, the 7-day Q_2 (see page 9 for definition) was chosen as a suitable parameter to describe the low-flow characteristics of the streams. Then, the draft-storage data were plotted against the 7-day Q_2 parameter for all continuous-record stations and regional curves were drawn.

The following example will illustrate the steps used in developing the regional curves:

(1) the 7-day Q_2 for Chariton River near Prairie Hill is

$$\frac{21 \text{ cfs}}{1,870 \text{ sq mi}} = 0.01 \text{ cfsm (see Fig. 1).}$$

(2) the storage at the Prairie Hill station corresponding to a draft rate of 0.06 cfsm or 112 cfs for a recurrence interval of 20 years is $\frac{34,000 \text{ ac.-ft.}}{1,870 \text{ sq mi}} = 18$ ac. ft./sq. mi.

(3) the storage required for the draft rate of 0.06 cfsm was then plotted against the 7-day Q_2, thus defining one point on the regional curves.

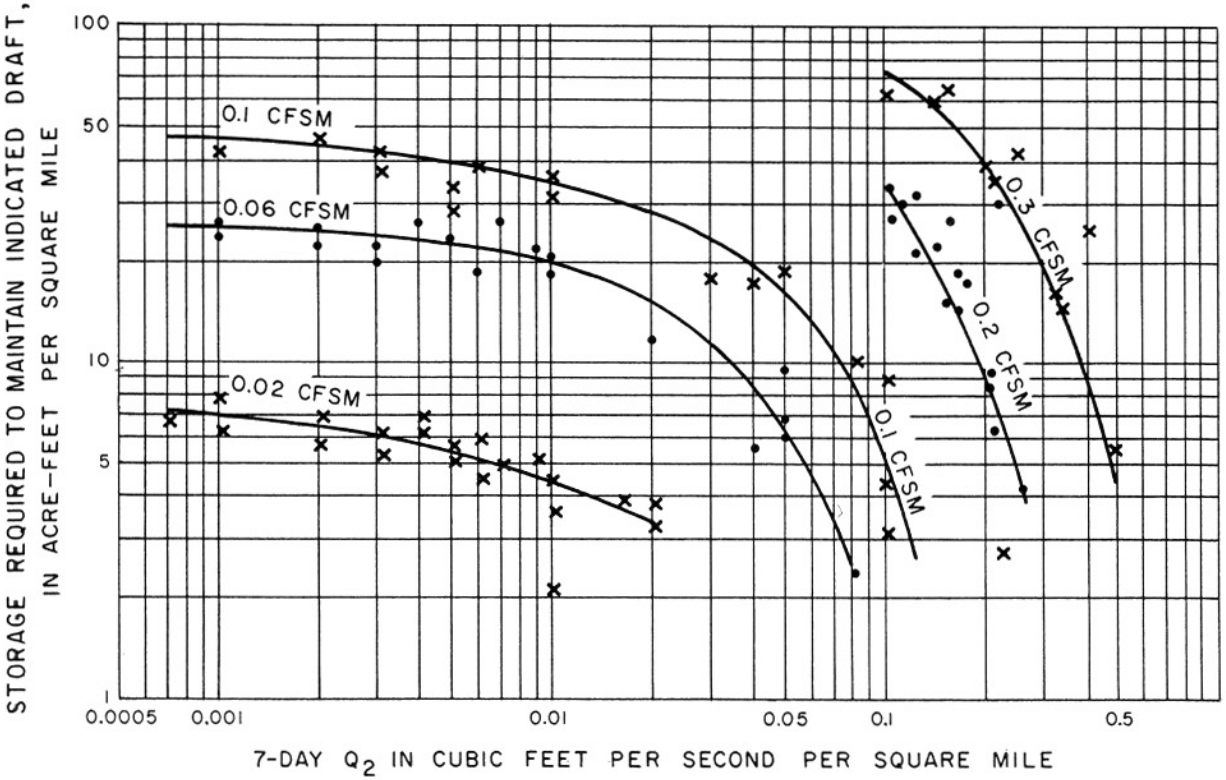
These procedures were followed, using selected draft rates of 0.02, 0.06, 0.1, 0.2, and 0.3 cfsm, for all long-time continuous-record stations in the state. Figure 4 is a presentation of the regional draft-storage curves.

The regional draft-storage curves were used in estimating storage requirements at all partial-record stations where the 7-day Q_2 could be defined and was greater than zero. These data are presented in the appendix and shown in Plate 1.

Partial-record stations and ungaged sites with 7-day Q_2 of zero.-- In order to roughly estimate storage requirements for a drought with recurrence interval of 20 years at partial-record stations and ungaged sites with 7-day Q_2 of zero, a constant storage requirement was determined for selected draft rates as shown in the following table:

Draft rate (cfsm)	0.02	0.06	0.10
Storage required (acre-feet per square mile)	7	25	47

Note: Storage estimates for sites in the Nodaway River basin must be multiplied by 0.6 to obtain storage required. In Spring and Elk Rivers, Shoal and Center Creek basins of southwest Missouri, estimates must be multiplied by 2.5 to obtain storage required.



NOTE: DRAFT RATE IS UNIFORM. STORAGE REQUIRED IS NOT ADJUSTED FOR RESESERVOIR SEEPAGE, SEDIMENTATION, AND EVAPORATION.

USE CONSTANT STORAGE REQUIREMENTS SHOWN IN THE SECTION "PARTIAL-RECORD STATIONS AND UNGAGED SITES WITH 7-DAY Q_2 OF ZERO" IF 7-DAY Q_2 IS LESS THAN 0.0007 CFSM.

STORAGE ESTIMATES FOR SITES IN THE NODAWAY RIVER BASIN MUST BE MULTIPLIED BY 0.6 TO OBTAIN STORAGE REQUIRED.

IN SPRING AND ELK RIVER, SHOAL AND CENTER CREEK BASINS OF SOUTHWEST MO., ESTIMATES MUST BE MULTIPLIED BY 2.5 TO OBTAIN STORAGE REQUIRED.

Fig. 4. Regional draft-storage curves, 20-year recurrence interval.

These average values were determined by computing data from continuous-record stations where 7-day Q_2 is zero and extrapolating regional draft-storage curves.

Application of regional draft-storage curves to ungaged sites.-- Reservoirs are rarely located at sites where long stream-flow records are available. Therefore, the regional draft-storage curves of Figure 4 or the constant storage requirements shown in the preceding section are used to make estimates of storage requirements at ungaged sites.

The following steps are necessary in making estimates of storage requirements at ungaged sites:

(1) Determine the drainage area upstream from the site.

(2) Estimate the 7-day Q_2. The estimate may be obtained from a few base-flow measurements, as described by Skelton (1966, p. 25). In the Ozarks region of Missouri (Figure 6) it is imperative that three or four base-flow measurements are obtained, preferably on different recessions in different years, before any estimate of the 7-day Q_2 is made. Large water losses or gains may be experienced in short reaches of Ozark streams.

(3) Enter Figure 4 with 7-day Q_2 in cfsm, intersect the appropriate regional draft curves, and read the estimated storages required in acre-feet per square mile from the ordinate scale.

(4) If the 7-day Q_2 is estimated to be zero, use the constant storage requirements shown in the table on page 13 to make estimates of storage requirements.

Limitations of Results

The amounts of storage required to sustain indicated draft rates at the stations listed in the appendix are hydrologically possible to attain. However, it is the job of the designer to determine if such storages are physically possible. The terrain may not be suitable for reservoir construction. It is not the purpose of this report to define the feasibility of specific projects. Therefore, hydrologic data alone are presented with no analysis of reservoir construction sites.

The draft rates selected for this report are those which can be maintained by storage which will be replenished each year. Higher draft rates can be obtained by utilizing excessive annual flows in years of deficient flow.

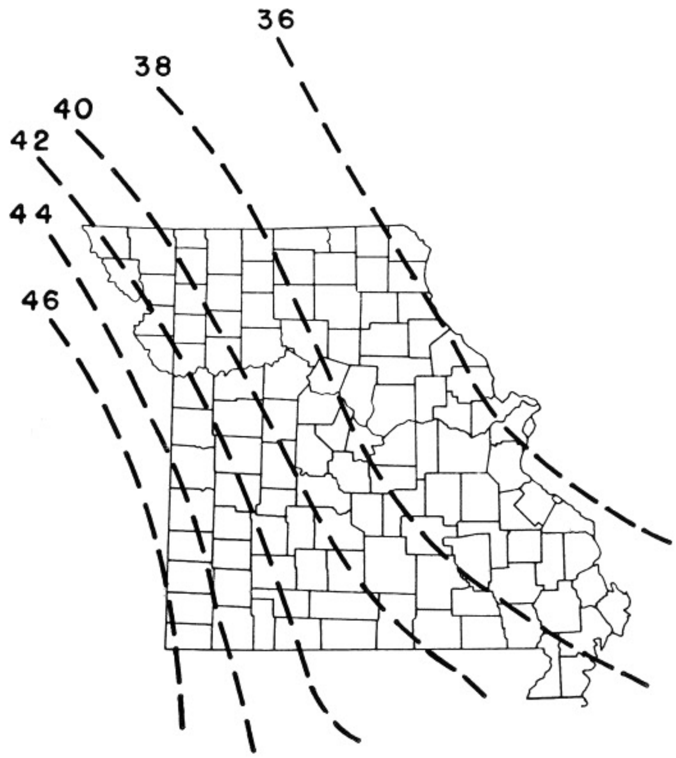
Gaging stations listed in the appendix do not include those operated by the Water Resources Division in the Southeastern Lowlands area, where the flat terrain prohibits utilization of storage reservoirs.

Estimates of storage requirements presented in this report are valid only if no appreciable man-made changes occur in the basins. Changes in the low-flow regimen of streams are brought about when natural conditions are altered. Storage estimates should be used with caution if significant man-made changes such as canalization occur in an area of interest.

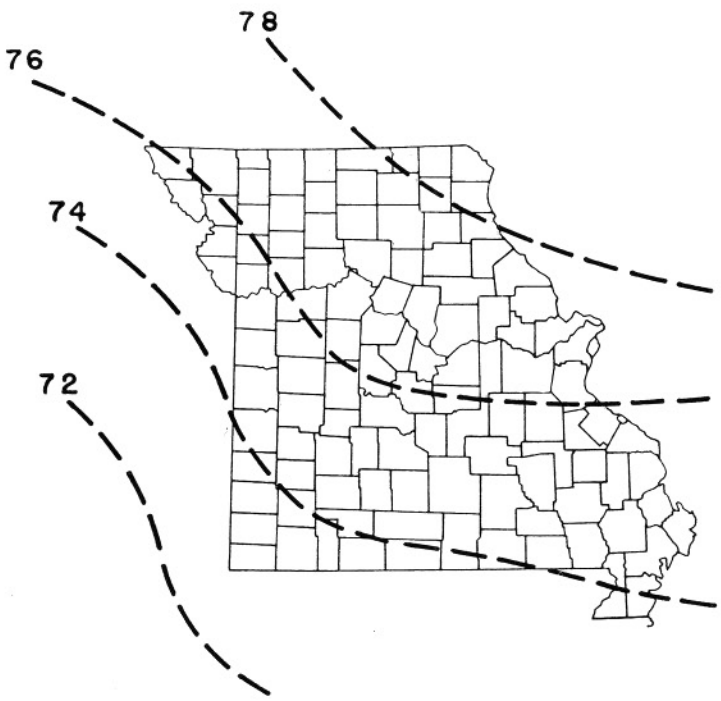
RESERVOIR LOSSES

Evaporation Loss

The gross water supply to a reservoir is inevitably lessened by evaporation, making the estimation of this loss an important factor in reservoir planning. The design of major storage projects often includes detailed study of observations made at the proposed reservoir sites,



Map A.-- Average Annual Lake Evaporation in Inches (Period 1946-55).



Map B.-- Average May-October evaporation in percent of annual. The ratios should be applied only in the case of shallow lakes where energy storage can be ignored.

Fig. 5. Maps for estimating free-water evaporation for reservoir design. From: U. S. Weather Bureau, Technical Paper No. 37, 1959.

but for lesser projects, generalized estimates of free-water evaporation may be adequate.

Generalized estimates of evaporation from water surfaces may be obtained from the maps of Figure 5. Map A presents average annual lake evaporation and map B presents average May-October evaporation in percent of annual. The evaporation loss appropriate to adjust within-year storage occurs during the critical 4-7 month period when evaporation losses are greatest. Therefore, map B should be utilized in estimating evaporation losses for reservoirs in Missouri.

To estimate losses from evaporation for the critical period multiply the surface area of the reservoir by the average May-October evaporation determined from Figure 5, maps A and B. For example, a lake in Laclede County with a surface area of 100 acres would lose (100 acres) $(\frac{40}{12}$ feet) (.75) = 248 acre-feet of water.

Reservoir Sedimentation

Sediment deposition occurs in any reservoir constructed to impound the waters of a flowing stream and in time robs most reservoirs of their capacity to store water. Table 1 presents available sedimentation data for the state. The information should be used as reconnaissance-type data during preliminary studies.

The drainage areas of many Missouri streams in the Osage and Dissected Till Plains (Figure 6) are cultivated and subject to soil erosion; consequently, these streams carry a variable but considerable load of soil or sediment particles which is generally greater than that carried by Ozark streams. An exception to this general rule occurs in areas of extensive mining in the Ozarks where stream sediment loads may approach those of streams in the Plains. An example of this situation is Grisham Reservoir near Bismarck, Missouri (see Table 1).

The annual rate of capacity loss can be converted to total capacity loss by selecting a time period, say 20 years, as a basis for planning. This 20-year total to be allocated for sediment storage can then be added to the original reservoir capacity estimate to provide for the amount of capacity lost during the 20-year period. This approach is conservative since the storage space allocated to sediment is actually filled with sediment gradually during the 20-year period.

Seepage Losses

(by James H. Williams, Missouri Geological Survey and Water Resources)

An evaluation of potential seepage losses is an integral part of reservoir design. Although study of reservoir sites is necessary for a precise evaluation of this factor, a general appraisal of seepage losses by physiographic areas will be of value in the design of small, general-purpose reservoirs.

On the basis of seepage losses into soil and bedrock, Missouri can be divided into four regions: 1) Dissected Till Plains, 2) Osage Plains, 3) Ozarks, and 4) Southeastern Lowlands (Figure 6). However, storage facilities cannot be utilized in the Southeastern Lowlands and Mississippi and Missouri River flood plains, so the aspects of seepage in these areas will not be discussed. Seepage losses in the Dissected Till Plains and the Osage Plains generally are low because of the homogeniety of the bedrock, soil, and vegetative cover. The modern soil is probably the single most important feature that affects seepage in these areas. However, in the Ozarks region of southern Missouri where soil, residuum, vegetation, bedrock, groundwater, and erosion cycles vary abruptly, the interpretation of seepage losses is more intricate. It

Table 1.--Summary of Reservoir Sedimentation Surveys Made in Missouri Through 1960
(From: U. S. Dept of Agriculture, 1964, Summary of reservoir sediment deposition surveys made in the United States through 1960: Miscellaneous Publication No. 964, pp. 8-22).

Reservoir	Stream	Nearest Town	Physiographic Region (see Figure 6)	Contributing Drainage Area (sq. mi.)	Date of Survey	Period Between Surveys (years)	Storage Capacity (acre-ft.)	Average Annual Sediment Accumulation per sq. mi. for Period	
								Ac. ft.	Tons
Glosier No. 1	Lost Creek	Elsberry	Dissected Till Plains	1.04	Apr. 1956	--	72.5	--	--
					July 1960	4.3	70.3	0.49	--
Ashland	Brushy Creek	Ashland	Dissected Till Plains	3.75	Apr. 1937	--	282.7	--	--
					Nov. 1949	12.6	213.0	1.47	2,209
					Apr. 1951	1.4	210.3	0.51	755
					July 1955	4.3	203.6	0.42	--
E. W. Howell	Tributary of Tarkio River	Tarkio	Dissected Till Plains	0.505	July 1942	--	33.7	--	--
					May 1949	6.9	0.03	9.66	15,250
L. H. Fuelling	Tributary of Tarkio River	Westboro	Dissected Till Plains	1.04	July 1939	--	31.80	--	--
					May 1949	9.8	1.93	2.93	3,990
Lake of the Ozarks (Bagnell Dam)	Osage River	Eldon	Osage Plains, Ozarks	13,900	Feb. 1931	--	2,087,223	--	--
					Oct. 1948	17.8	1,972,531	0.464	598
McDaniel Lake	Little Sac River	Spring-field	Ozarks	41.5	-- 1929	--	3,452	--	--
					June 1940	11	3,207	0.538	703
Grisham	Lost Creek (drains mining area)	Bismarck	Ozarks	0.45	Oct. 1930	--	24.05	--	--
					July 1939	8.8	19.56	1.133	1,860
Killarney	Big Creek	Annapolis	St. Francois Mountains	51	-- 1910	--	818	--	--
					-- 1939	29	622	0.133	174
Mountain Lake	Tributary of Rings Creek	Patterson	Ozarks	1.87	-- 1927	--	87.7	--	--
					July 1939	12	82.9	0.213	254
Shepherd Mountain	Tributary of Stouts Creek	Ironton	St. Francois Mountains	3.96	-- 1929	--	171	--	--
					July 1939	10	158	0.338	471
Wappapello	St. Francis River	Poplar Bluff	Ozarks	1,206	July 1940	--	625,000	--	--
					July 1947	7.0	624,651	0.041	--

Table 1. Summary of reservoir sedimentation surveys made in Missouri through 1960.

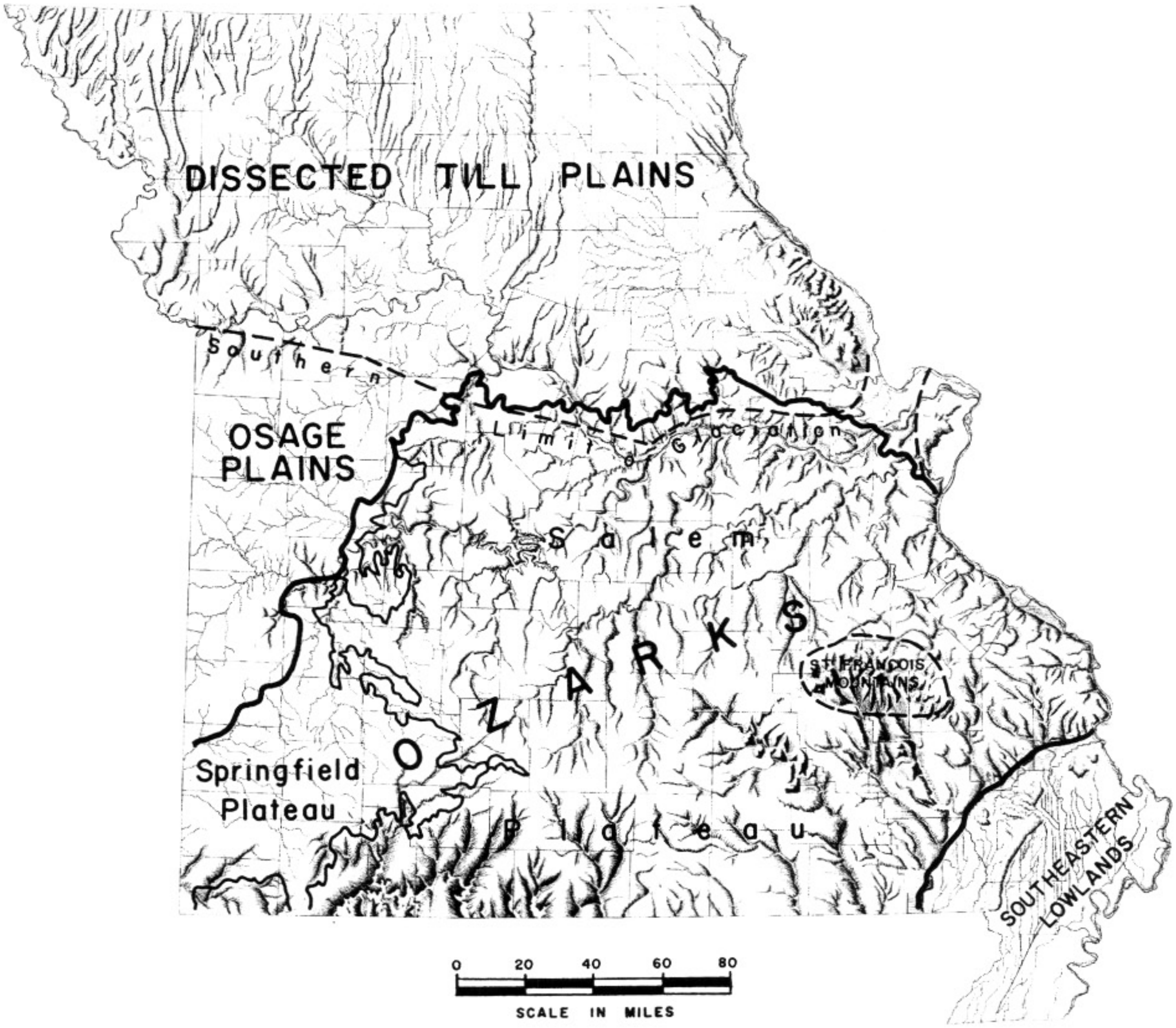


Fig. 6. Map showing the physiographic divisions of Missouri.

is seldom that there is a single physical feature, such as soil, that can be considered as the principal cause for high or low seepage rates.

1) Dissected Till Plains -- Northern Missouri has been modified by glaciation. Varying thickness of glacial drift and loess, ranging from a few feet to more than 300 feet, cover the area. The glacial drift generally consists of jointed, moderately permeable, glacial till with lenticular bodies of sand and gravel. The loess varies from jointed, permeable silt reaching thicknesses of more than 50 feet along the Missouri and Mississippi Rivers to relatively impermeable, loess-derived claypan soils on the plains of north-central Missouri. The dissected areas of northern Missouri near the major rivers and large tributaries are mantled by moderately permeable soil that is derived from glacial drift or reworked loess. The plains between the rivers are underlain by claypan soils and seepage rates are sharply reduced as the result of the nearly impermeable clay subsoil. Rates of water runoff and intake in soil with related factors such as slope and vegetative cover have been noted in studies conducted by the University of Missouri Extension Service (Jamison and Thornton, 1959, and Minshall, 1961).

2) Osage Plains -- The western part of Missouri is underlain by Pennsylvanian deposits of sandstone, shales, and thin limestones. Soil cover is thin over the southern part of this region and thick but with claypan subsoil over the northern part. Therefore, seepage is slow and flash floods are frequent because of the high runoff.

3) Ozarks -- The area of southern Missouri including the rugged countryside along the Missouri River in central Missouri and the eastern part of Missouri adjacent to the Mississippi River can be divided into several areas from the aspect of seepage.

These areas are:

a. Springfield Plateau
b. Salem Plateau
c. Ozark Foothills adjacent to the southeastern Lowlands
d. St. Francois Mountains
e. The Missouri and Mississippi River Hills

In all of these areas the following interrelated geologic and physiographic characteristics influence seepage:

1. A varied and complex topography where the degree of weathering is related to the age of the exposed surface. Broad flat uplands that have undergone a long period of weathering have developed deep permeable soils (residuum) and weathered bedrock, whereas, younger steep ridge and valley areas that are being dissected by continuous erosive forces have been stripped of residuum and weathered bedrock.
2. Locally thick, permeable residuum of relatively insoluble and unconsolidated material, mostly chert and sandstone fragments derived from bedrock by weathering.
3. Stream channel development or lack of such development, especially in valleys choked with residuum.
4. Cavernous underdrainage in bedrock, which includes vast areas of once active sinkholes but which now have only a few remnants of the former karst topography.
5. Active sinkhole areas of karst topography where most of the surface runoff is rapidly lost to subsurface bedrock.

6. Springs which generally have as their watershed sources active sinkholes or broad permeable uplands that were once active sinks.
7. Abrupt lateral changes in the groundwater table. Groundwater "faults" with a 200-foot vertical displacement in a lateral distance of three to five miles are common.

a) Springfield Plateau

In southwestern Missouri (Greene, Lawrence, Jasper, and Newton Counties) permeable cherty clay soils and permeable residuum underlain by moderately cavernous bedrock have contributed to a high rate of seepage with comparatively little surface runoff except during intense storms. Topographically the region is relatively level. Locally, intense sinkhole development surrounded by areas of broad and poorly defined valleys, which in effect are sinkholes from the aspect of a high surface water loss, create tremendous pollution and reservoir leakage hazards. The intense weathering of the plateau is related to the topography, the carbonate bedrock, and the low groundwater level. This has resulted in a well structured, jointed, permeable, cherty clay residuum and cavernous bedrock. Near the southeastward facing Eureka Springs Escarpment of the Springfield Plateau, erosion has and is continuing to strip the permeable residual soils and leave rugged valleys cut into fresh bedrock that is less cavernous. Groundwater levels are closer to the surface in this area and springs are common. Seepage rates are much lower than on the uplands of the Springfield Plateau and the area is more suitable for reservoir development.

b) Salem Plateau

The Salem Plateau, in the central part of the Ozarks, is extremely variable. Areas of sinkholes, extremely low watertable levels, dry stream channels, or thick permeable residuum can be found adjacent to sections with thin soil and tight bedrock, well defined stream channels, perennial streams, springs and high groundwater levels. Changes are abrupt and the lateral distance between such areas is sometimes less than a mile.

Outstanding areas of extremely permeable residuum, cavernous bedrock, active or inactive sinkholes, low groundwater levels, and poorly defined stream channels are present in Oregon, Howell, and portions of Phelps, Dent, and Texas Counties in south-central Missouri. Residuum developed by intensive weathering throughout a long period of geologic time coupled with present day effects of low groundwater level and cavernous bedrock has resulted in widespread development of permeable surface soils with high seepage losses. The residuum mantle has a high moisture intake capacity not only because of the permeable soils but also because subsoil moisture is rapidly lost by vertical seepage to the low groundwater table.

c) Ozark Foothills

The Ozark Foothills area adjacent to the Southeastern Lowlands has been deeply weathered, possibly more so than any other area of southern Missouri. Seepage losses into the deeply weathered permeable residuum are high.

d) St. Francois Mountains

The St. Francois Mountains of the eastern portion of the Ozarks are restricted to rugged countryside where most of the hills are underlain by igneous bedrock. The highest point in Missouri, Taum Sauk Mountain, is an igneous hill in this area. The numerous hills and ridges, however, do not have concordant elevations.

The St. Francois Mountains are characterized by high groundwater level, abundance of small perennial streams and springs, regionally a thin permeable residuum, and less cavernous bedrock. Locally residuum may be up to 60 feet in thickness. Seepage in isolated areas may be relatively high, but regionally it can be considered moderate.

e) Missouri and Mississippi River Hills

In eastern Missouri along the Mississippi River and bordering the Missouri River in the central part of the state, sinkholes, large caves, dry stream channels, and permeable soils are locally outstanding features in an area where the general surface conditions that affect seepage are moderate. The local hazards of cavernous conditions and high seepage areas exist as they do throughout the plateaus of southern Missouri, but here they can be separated and considered as isolated problems.

Regional summary.-- The following summary indicates the relative magnitude of seepage losses by physiographic region.

1. Dissected Till Plains: losses are low in the Plains between rivers. Moderate losses occur near the major rivers and tributaries.
2. Osage Plains: losses are insignificant.
3. Springfield Plateau: high seepage rates on flat uplands. Near the Eureka Springs Escarpment, seepage rates are much less with good possibilities for reservoir development.
4. Salem Plateau: seepage losses quite variable with areas of high and low losses randomly interspersed. Careful study of the geologic setting near proposed reservoir sites is required.
5. Ozark Foothills: losses uniformly high.
6. St. Francois Mountains, Mississippi and Missouri River Hills: losses high in isolated areas, but generally moderate.

HOW TO USE THE REPORT - A SUMMARY

I. <u>Storage requirements at gaging stations</u>

A - Locate stations by referring to Plate 1. If the reader is interested in a particular stream he should refer to the station index at the end of the report to see if information is available at any point on the stream.

B - Refer to the appendix for all available storage information at gaged sites. Note that these data are not corrected for reservoir losses.

II. <u>Storage requirements at ungaged sites</u>

The procedures for estimating storage requirements at an ungaged site may be illustrated by hypothetical problems:

Problem 1:

Industrial planners wish to locate a plant on Osage Fork in Laclede County. The industry will require a dependable flow of 20 cfs at all times and the planners need to know (1) if such a supply is available at the proposed site and (2) approximately how much storage would be required to sustain the draft rate.

Assume that the drainage area upstream from the proposed site is 200 square miles, that no discharge measurements have ever been made in the vicinity, and that reservoir storage is to be replenished each year.

Solution 1:

(a) The first step is estimation of the 7-day Q_2 at the site. Three or four base flow measurements must be made at sites in the Ozarks region (Figure 6) prior to estimation of 7-day Q_2. These measurements should be made on different recessions in different years.

(b) After base flow measurements are obtained, the 7-day Q_2 can be determined by correlative procedures which involve the use of concurrent base flow discharges on streams draining areas of similar surficial geology (Skelton, 1966, p. 25). Assume that the 7-day Q_2 is approximately 20 cfs.

(c) Entering Figure 4 with 7-day $Q_2 = \frac{20 \text{ cfs}}{200 \text{ sq mi}} = 0.10$ cfsm, the following estimates are obtained for a drought with recurrence interval of 20 years:

Draft rate		Storage required	
Cfsm	Cfs	Ac-ft/sq. mi.	Ac-ft
.1	20	4.7	940
.2	40	33	6,600
.3	60	74	14,800

(d) After the initial computations are completed, storage estimates must be increased to allow for water lost by evaporation and seepage and for reduction in storage capacity from sediment deposition.

(1) To estimate losses from evaporation, the maps of Figure 5 must be utilized. Assume that the effective evaporative area is equal to the surface area of the full reservoir.

For illustrative purposes, assume that the lake surface areas for the storage requirements of step C are 200, 800, and 1,500 acres respectively.

The site is near the 40 inch (3.3 feet) isopleth on map A. However, the evaporation loss appropriate to adjust within-year storage occurs when evaporation losses are greatest, and map B is utilized to estimate a seasonal factor of about 75 percent.

The computations necessary to determine estimated losses from evaporation are as follows:

(200 acres) (3.3 feet) (.75) = 500 acre-feet

(800 acres) (3.3 feet) (.75) = 2,000 acre feet

(1,500 acres) (3.3 feet) (.75) = 3,710 acre feet

(2) Quantitative estimates of seepage losses for a specific site cannot be determined from this report. However, the report can be utilized to determine if the possibility of large seepage losses should be investigated more fully in an area of interest.

As shown on Figure 6, Laclede County is located on the Salem Plateau. The summary of regional seepage loss potential on page 23 indicates that seepage losses in this region are quite variable with areas of high and low losses randomly interspersed. Therefore, a careful study of the geologic setting at the proposed reservoir site is necessary to evaluate the possibility of significant seepage losses.

(3) Quantitative estimates of sediment deposition can be made by use of Table 1.

For this problem, assume a time period of 20 years for converting annual loss to total capacity loss.

Table 1 indicates that the range in average annual sediment accumulation in storage reservoirs in the Ozarks region is from 0.04 to 1.13 acre-feet per square mile of drainage area. However, McDaniel Lake, with an average annual accumulation of about 0.5 acre-feet per square mile is located near the study area, and this figure should be used to estimate losses from sediment deposition for this problem.

The computation necessary to determine estimated loss from sediment deposition is as follows: (20 years) (200 sq mi) (0.5 acre-feet per sq mi per year) = 2,000 acre-feet.

(e) After computation of all reservoir losses, the estimates of step c are finalized as follows:

Draft rate in cfs	Storage required in acre-feet (20-year recurrence interval drought)
20	940 + 500 + 2,000 = 3,440 acre-feet
40	6,600 + 2,000 + 2,000 = 10,600 acre-feet
60	14,800 + 3,710 + 2,000 = 20,510 acre-feet

From the foregoing procedures the industrial planners learned (1) that the surface water supply at the proposed site is sufficient for their needs and (2) the approximate amount of storage required to supply their needs during a drought with recurrence interval of 20 years. A more detailed engineering study at the site would be required to determine if the terrain is suitable for construction of a reservoir of the size required.

Problem 2:

A municipality is interested in building a storage reservoir on an intermittent stream in southern Cass County. The city planners want to get a rough idea of the storage-draft relationship at the proposed site.

Assume that the drainage area upstream from the proposed site is 70 square miles and that reservoir storage is to be replenished each year.

Solution 2:

(a) The city planners know from past experience that the stream ceases to flow for periods of several weeks each year during late summer and early fall. They conclude that the 7-day Q_2 is zero.

(b) The constant storage requirements shown in the section "partial-record stations and ungaged sites with 7-day Q_2 of zero", page 13, are applicable to this problem. Using the storage requirements indicated in the table on page 13, the planners obtain the following estimates for a drought with recurrence interval of 20 years:

Draft rate		Storage required	
Cfsm	Cfs	Acre-feet/sq. mi.	Acre-feet
.02	1.4	7	490
.06	4.2	25	1,750
.10	7.0	47	3,290

(c) The storage estimates must be increased to allow for water lost by evaporation and seepage and for reduction in storage capacity from sediment deposition. Assume that the effective evaporative area is equal to the surface area of the full reservoir.

(1) Assume that the lake surface areas for the storage requirements of step b are 100, 200, and 400 acres respectively and utilize the maps of Figure 5 as described in problem 1.

The computations necessary to determine estimated losses from evaporation are as follows:

(100 acres) (3.2 feet) (.77) = 250 acre-feet

(200 acres) (3.2 feet) (.77) = 500 acre-feet

(400 acres) (3.2 feet) (.77) = 1,000 acre-feet

(2) Quantitative estimates of seepage losses for a specific site cannot be determined from this report. However, the report can be utilized as described in problem 1 to determine if there is a possibility of significant seepage losses.

Figure 6 shows that Cass County is located on the Osage Plains. The summary of seepage loss potential on page 23 indicates that seepage loss is insignificant for this region. These losses can be disregarded for this problem.

(3) Quantitative estimates of sediment deposition can be made by use of Table 1. Assume a time period of 20 years for converting annual loss to total capacity loss.

From Table 1, it is determined that the nearest reservoir which has been surveyed for sediment accumulation is Lake of the Ozarks. The average annual sediment accumulation in this reservoir is about 0.5 acre-feet per square mile.

The computation necessary to determine estimated loss from sediment deposition is as follows: (20 years) (70 sq. mi.) (0.5 acre-feet per sq. mi. per year) = 700 acre feet.

(d) After computation of all reservoir losses, the estimates of step b are finalized as follows:

Draft rate in cfs	Storage required in acre-feet (20-year recurrence interval drought)
1.4	490 + 250 + 700 = 1,440 acre-feet
4.2	1,750 + 500 + 700 = 2,950 acre-feet
7.0	3,290 + 1,000 + 700 = 4,990 acre-feet

From the foregoing procedures the city planners got a rough idea of the storage-draft relationship at the proposed site. A detailed engineering study would be required to determine if the terrain is suitable for construction of a reservoir.

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APPENDIX

Draft-Storage-Frequency Data at Continuous-Record and Partial-Record Streamflow Stations in Missouri

This appendix presents draft-storage-frequency data at stream-gaging stations in Missouri. The data were not corrected for evaporation, sedimentation, and seepage losses. Storage estimates are hydrologically feasible. Physical properties at the sites which may make the estimates impossible to attain were not considered.

These data should not be extrapolated to higher draft rates; the curves may break sharply in this range.

Station number is a nationwide identification number used by the U. S. Geological Survey to locate the stations in downstream order. Stations are arranged in downstream order in this appendix; however, an alphabetical listing with station numbers is provided in the station index.

Station name gives the name of the continuous-record or partial-record station and a brief reference to a nearby town or city. See Plate 1 for exact station locations.

Record used in analysis shows the water years for which daily discharge record was available at continuous-record stations. For partial-record stations the water years in which discharge measurements were made are shown. These are the same records used in low-flow frequency analyses for Missouri (Skelton, 1966) and are considered representative of long-time streamflow patterns in the state.

Under drainage area is the most recently determined drainage area based on the most accurate maps available at the time of the determination. Rough drainage areas (accurary ± 10%), which were used in storage computations for partial-record stations, are not shown in this report. A subsequent report will contain planimetered drainage area information for the state.

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
5-4950	Fox River at Wayland	1922-59	[a]400		2 cfs	5 cfs	8 cfs	15 cfs	18 cfs
				10	0.30	1.05	1.98	4.56	5.55
				30	0.52	1.49	2.54	5.35	6.74
5-4958	North Wyaconda River near Granger	1962-64	-		2 cfs	5 cfs	10 cfs	- -	- -
				20	0.70	2.10	4.70	-	-
5-4960	Wyaconda River above Canton	1933-59	393		5 cfs	8 cfs	10 cfs	20 cfs	24 cfs
				10	1.15	2.02	2.68	6.35	7.93
				30	1.63	2.78	3.61	8.33	10.5
5-4969.5	North Fabius River at Memphis	1942-43, 1945-48, 1953, 1962-64	-		3 cfs	10 cfs	20 cfs	- -	- -
				20	0.80	3.74	8.30	-	-
5-4970	North Fabius River at Monticello	1922-59	452		2 cfs	5 cfs	10 cfs	15 cfs	22 cfs
				10	-	0.81	2.08	3.57	5.95
				30	0.52	1.43	3.13	4.96	7.93

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
5-4980	Middle Fabius River near Monticello	1946-61	393		2 cfs	5 cfs	10 cfs	20 cfs	30 cfs
				5	-	0.48	1.37	3.97	7.34
				20	0.47	1.31	2.97	7.24	12.5
5-4985	North Fabius River at Taylor[b,c]	1931-40	930		20 cfs	60 cfs	90 cfs	- -	- -
				20	5.50	23.0	36.5	-	-
5-5000	South Fabius River near Taylor	1935-59	620		10 cfs	20 cfs	40 cfs	60 cfs	84 cfs
				10	1.90	4.56	11.3	19.0	29.3
				30	3.17	6.84	15.5	25.4	37.7
5-5005	North River at Bethel	1937-63	[a]58		1 cfs	2 cfs	4 cfs	6 cfs	8 cfs
				10	0.25	0.59	1.37	2.18	3.13
				30	0.36	0.79	1.78	2.82	3.97
5-5010	North River at Palmyra	1935-61	373		10 cfs	20 cfs	30 cfs	40 cfs	46 cfs
				10	2.38	5.55	9.32	13.3	15.9
				30	3.57	8.13	13.3	18.8	21.8

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
5-5022	Salt River near Novelty	1962-64	-		3 cfs	10 cfs	15 cfs	-	-
				20	1.06	4.35	6.90	-	-
5-5025	Salt River near Shelbina	1934-58	481		15 cfs	20 cfs	40 cfs	60 cfs	72 cfs
				10	4.00	5.55	13.1	21.8	27.4
				30	6.05	8.33	17.6	28.0	34.7
5-5029	Black Creek at Shelbyville [d]	1942-43, 1945-47, 1953, 1962-64	-		1.5 cfs	4 cfs	6.5 cfs	-	-
				20	0.55	1.75	3.06	-	-
5-5044	South Fork Salt River at Mexico	1933-34, 1962-64	-		2 cfs	8 cfs	10 cfs	-	-
				20	0.60	3.00	3.90	-	-
5-5050	South Fork Salt River at Santa Fe	1940-58	298		2 cfs	4 cfs	6 cfs	8 cfs	10 cfs
				5	0.24	0.60	1.05	1.55	2.08
				20	0.59	1.29	2.02	2.78	3.57

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
5-5060	Youngs Creek near Mexico	1937-58	67.4		.5 cfs	1 cfs	2 cfs	2.5 cfs	3 cfs
				5	-	0.20	0.44	0.58	0.71
				20	0.12	0.26	0.59	0.78	0.99
5-5065	Middle Fork Salt River at Paris	1940-61	356		10 cfs	20 cfs	30 cfs	40 cfs	53 cfs
				5	2.14	4.92	7.93	11.3	15.9
				20	4.36	9.32	14.5	19.8	27.4
5-5070	Elk Fork Salt River near Paris [b]	1935-54	262		3 cfs	5 cfs	10 cfs	15 cfs	25 cfs
				5	-	0.69	1.78	3.07	6.25
				20	0.79	1.53	3.57	5.85	10.7
5-5075	Salt River near Monroe City	1940-58	[a]2,230		50 cfs	100 cfs	200 cfs	250 cfs	275 cfs
				5	5.75	15.9	46.6	65.4	75.4
				20	15.5	36.1	84.3	109	121
5-5080	Salt River near New London	1923-57	[a]2,480		50 cfs	100 cfs	200 cfs	250 cfs	308 cfs
				10	7.93	21.8	57.5	77.3	101
				30	13.9	34.7	83.3	109	137

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE 1)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
5-5088	Spencer Creek near Frankford	1930-36 1962-64	-		4.5 cfs	15 cfs	20 cfs	-	-
				20	1.58	6.20	9.30	-	-
5-5143	North Fork Cuivre River at Silex	1962-64	-		5 cfs	15 cfs	25 cfs	-	-
				20	1.50	6.00	10.5	-	-
5-5144.5	West Fork Cuivre River near Troy	1962-64	-		10 cfs	35 cfs	55 cfs	-	-
				20	3.00	15.0	25.0	-	-
5-5145	Cuivre River near Troy	1922-59	903		5 cfs	10 cfs	15 cfs	20 cfs	27 cfs
				10	0.52	1.43	2.54	3.77	5.75
				30	0.93	2.68	4.76	7.14	10.5
5-5146	Big Creek near Moscow Mills [d]	1962-64	-		2.5 cfs	7 cfs	12 cfs	-	-
				20	0.80	2.80	5.18	-	-

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
5-5147.1	Peruque Creek near Wentzville [d]	1942-43, 1946, 1948, 1953, 1962-63	-		1 cfs	3 cfs	5 cfs	-	-
				20	0.32	1.20	2.16	-	-
5-5147.2	Dardenne Creek near Weldon Spring [d]	1942-43, 1946, 1948, 1953, 1961-63	-		1 cfs	3 cfs	5 cfs	-	-
				20	0.32	1.20	2.16	-	-
6-8125	West Tarkio Creek near Westboro [b,c]	1934-39	105		2 cfs	6 cfs	10 cfs	-	-
				20	0.50	2.25	4.25	-	-
6-8130	Tarkio River at Fairfax	1922-59	508		5 cfs	10 cfs	15 cfs	20 cfs	24 cfs
				10	-	0.89	1.98	3.37	4.46
				30	0.59	1.75	3.27	5.16	6.74
6-8175	Nodaway River near Burlington Junction	1922-59	[a]1,240		20 cfs	25 cfs	50 cfs	60 cfs	66 cfs
				10	0.79	1.49	7.93	11.1	13.1
				30	1.82	2.93	11.7	15.5	17.8

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
6-8178	Nodaway River near Oregon	1942-43, 1946, 1962-64	-		35 cfs	105 cfs	175 cfs	- -	- -
				20	4.51	21.0	36.7	-	-
6-8190.1	Long Creek near Guilford [d]	1942-43, 1946, 1962-64	-		.5 cfs	2 cfs	3.5 cfs	- -	- -
				20	0.15	0.85	1.64	-	-
6-8195	One Hundred and Two River near Maryville	1933-59	[a]500		5 cfs	8 cfs	10 cfs	15 cfs	19 cfs
				10	0.83	1.75	2.42	4.36	6.15
				30	1.33	2.48	3.33	5.55	7.54
6-8204	White Cloud Creek near Barnard [d]	1942-43, 1946, 1962-64	-		1 cfs	3.5 cfs	6 cfs	- -	- -
				20	0.30	1.45	2.82	-	-
6-8204.8	One Hundred and Two River near St. Joseph	1962-64	-		15 cfs	45 cfs	75 cfs	- -	- -
				20	3.50	16.0	26.0	-	-

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
6-8205	Platte River near Agency	1933-59	[a]1,760		10 cfs	20 cfs	30 cfs	50 cfs	67 cfs
				10	0.91	3.17	6.15	13.1	19.2
				30	1.41	4.46	8.33	16.5	23.4
6-8209	Castile Creek near Gower	1942-43, 1946, 1962-64	-		3 cfs	10 cfs	15 cfs	- -	- -
				20	1.05	4.20	6.95	-	-
6-8211	Little Platte River near Trimble [d]	1962-64	-		3.5 cfs	10 cfs	20 cfs	- -	- -
				20	1.25	4.20	9.50	-	-
6-8940	Little Blue River near Lake City	1948-61	184		2 cfs	3 cfs	5 cfs	8 cfs	12 cfs
				5	-	-	0.56	1.31	2.62
				20	0.58	0.99	1.92	3.37	5.51
6-8943	Fishing River at Mosby	1962-64	-		2.5 cfs	7.5 cfs	15 cfs	- -	- -
				20	0.70	2.65	6.60	-	-

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
6-8944	Williams Creek near Mosby [d]	1962-64	-		0.5 cfs	1 cfs	2 cfs	- -	- -
				20	0.20	0.40	0.94	-	-
6-8946	Fishing River near Orrick	1962-64	-		5.5 cfs	15 cfs	25 cfs	- -	- -
				20	1.35	5.10	9.70	-	-
6-8950	Crooked River near Richmond	1948-59	159		2 cfs	3 cfs	5 cfs	8 cfs	11 cfs
				5	0.24	0.46	0.99	1.98	3.07
				20	0.53	0.93	1.86	3.37	4.86
6-8950.5	West Fork Crooked River at Richmond [d]	1943, 1945-46, 1953, 1962	-		0.5 cfs	2 cfs	3.5 cfs	- -	- -
				20	0.10	0.80	1.64	-	-
6-8960	Wakenda Creek at Carrollton	1948-61	248		2 cfs	3 cfs	5 cfs	7 cfs	11 cfs
				5	-	0.20	0.61	1.19	2.58
				20	0.43	0.74	1.47	2.28	3.97

DRAFT - STORAGE - FREQUENCY DATA AT CONTINUOUS - RECORD AND PARTIAL - RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
6-8961.6	Grand River near Grant City	1962-64	-		4.5 cfs	15 cfs	20 cfs	- -	- -
				20	1.10	5.40	7.60	-	-
6-8961.7	Grand River near Stanberry	1943, 1946-47, 1953, 1962-64	-		6.5 cfs	20 cfs	35 cfs	- -	- -
				20	1.40	6.60	12.9	-	-
6-8961.85	Middle Fork Grand River at Grant City	1943, 1946, 1962-64	-		1.5 cfs	4.5 cfs	7.5 cfs	- -	- -
				20	0.52	1.88	3.41	-	-
6-8961.9	Middle Fork Grand River near Albany	1943, 1946, 1953, 1962-64	-		4 cfs	12 cfs	20 cfs	- -	- -
				20	0.93	4.16	7.40	-	-
6-8964	East Fork Grand River at Albany	1943, 1946-47, 1962-64	-		6 cfs	20 cfs	30 cfs	- -	- -
				20	1.45	7.10	11.6	-	-
6-8965.5	Grand River near Darlington	1929-31, 1962-64	-		20 cfs	60 cfs	100 cfs	- -	- -
				20	4.00	20.0	36.5	-	-

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6-8967.5	West Fork Lost Creek at Maysville [d]	1943, 1945-46, 1962-64	-		.5 cfs	2 cfs	3.5 cfs	-	-
				20	0.15	0.85	1.64	-	-
6-8968	Lost Creek near Weatherby [d]	1943, 1945-47, 1962-64	-		3 cfs	10 cfs	15 cfs	-	-
				20	1.05	4.20	7.10	-	-
6-8969	Grand River near Pattonsburg	1958, 1960-64	1,680		30 cfs	60 cfs	100 cfs	-	-
				20	7.00	17.0	33.0	-	-
6-8971	Big Creek at Bethany [d]	1934, 1943, 1946, 1953, 1962-64	-		6 cfs	20 cfs	30 cfs	-	-
				20	2.65	8.25	13.6	-	-
6-8975	Grand River near Gallatin	1921-57	2,250		20 cfs	40 cfs	60 cfs	80 cfs	129 cfs
				10	2.14	8.33	16.3	23.4	39.7
				30	3.97	11.5	19.8	28.2	49.6

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6-8981	Thompson River near Mt. Moriah [c]	1960-64	891		20 cfs	50 cfs	90 cfs	-	-
				20	4.50	16.5	32.5	-	-
6-8981.1	Panther Creek at Mt. Moriah	1962-64	-		.5 cfs	2 cfs	3 cfs	-	-
				20	0.15	0.90	1.41	-	-
6-8985	Weldon River near Mercer [b]	1940-58	246		2 cfs	4 cfs	6 cfs	10 cfs	17 cfs
				5	0.20	0.71	1.39	2.82	5.85
				20	0.69	1.55	2.42	4.16	7.34
6-8990	Weldon River at Mill Grove	1930-58	494		5 cfs	10 cfs	20 cfs	30 cfs	41 cfs
				10	1.09	2.93	7.20	11.5	16.3
				30	1.61	3.87	9.12	14.5	20.8
6-8991	Weldon River near Trenton	1961-64	-		10 cfs	35 cfs	55 cfs	-	-
				20	2.00	11.5	19.5	-	-

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6-8995	Thompson River at Trenton	1929-58	1,670		30 cfs	40 cfs	50 cfs	75 cfs	117 cfs
				10	4.96	8.43	12.3	23.0	40.8
				30	6.50	10.3	14.3	25.4	45.6
6-8995.5	Muddy Creek at Trenton	1962-64	-		2.5 cfs	7.5 cfs	12 cfs	- -	- -
				20	0.79	3.00	5.44	-	-
6-8995.7	Honey Creek near Trenton	1962-64	-		1.5 cfs	5 cfs	8 cfs	- -	- -
				20	0.52	2.10	3.80	-	-
6-8996.8	Grand River at Chillicothe	1934, 1936, 1957-58, 1961-64	-		100 cfs	200 cfs	300 cfs	- -	- -
				20	16.5	50.0	87.5	-	-
6-8996.9	Shoal Creek at Kingston	1942-43, 1945-46, 1962-64	-		4 cfs	10 cfs	20 cfs	- -	- -
				20	1.30	3.95	9.00	-	-
6-8997	Shoal Creek near Braymer [c]	1958-62	391		8 cfs	25 cfs	40 cfs	- -	- -
				20	2.50	10.0	17.0	-	-

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6-8998	Shoal Creek near Chillicothe	1942-43, 1945-46, 1962-64	-		10 cfs	40 cfs	60 cfs	- -	- -
				20	3.00	16.5	25.8		
6-9000	Medicine Creek near Galt	1930-58	225		2 cfs	3 cfs	4 cfs	6 cfs	9 cfs
				10	0.16	0.45	0.76	1.47	2.74
				30	0.21	0.58	0.95	1.80	3.17
6-9005	Medicine Creek near Sturges [e]	1930-33, 1962-64	368		8 cfs	20 cfs	35 cfs	- -	- -
				20	1.80	6.25	12.8	-	-
6-9006	Medicine Creek near Wheeling	1942-43, 1945-47, 1962-64	-		10 cfs	30 cfs	50 cfs	- -	- -
				20	2.18	10.0	18.0	-	-
6-9007	Parson Creek at Meadville [d]	1942-43, 1945-47, 1962-64	-		4 cfs	10 cfs	20 cfs	- -	- -
				20	1.40	4.15	9.50	-	-

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6-9015	Locust Creek near Linneus	1929-58	[a]550		5 cfs	8 cfs	10 cfs	15 cfs	21 cfs
				10	0.59	1.33	1.90	3.53	5.55
				30	0.85	1.88	2.68	5.00	8.13
6-9020	Grand River near Sumner	1925-58	[a]6,880		100 cfs	150 cfs	200 cfs	300 cfs	365 cfs
				10	10.5	22.8	37.3	70.4	95.2
				30	13.9	29.7	48.6	87.3	115
6-9022	West Yellow Creek near Brookfield [c]	1959-64	135		2.5 cfs	8 cfs	15 cfs	- -	- -
				20	0.85	3.20	6.75	-	-
6-9023	West Yellow Creek below Brookfield [d]	1942-43, 1945-47, 1953, 1962-64	-		3.5 cfs	10 cfs	20 cfs	- -	- -
				20	1.15	4.20	9.50	-	-
6-9029	East Yellow Creek near Brookfield [d]	1942-43, 1945-47, 1953, 1962-64	-		3.5 cfs	10 cfs	20 cfs	- -	- -
				20	1.15	4.20	9.90	-	-
6-9030	Yellow Creek near Rothville [b,c]	1929-31, 1949-50	405		8 cfs	25 cfs	40 cfs	- -	- -
				20	2.70	10.4	18.4	-	-

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6-9031	Turkey Creek near Laclede [d]	1942-43, 1945-47, 1953, 1962-64	-		.5 cfs	2 cfs	3 cfs	-	-
				20	0.20	0.90	1.41	-	-
6-9044	Blackbird Creek near Unionville [d]	1942-43, 1945-48, 1962-64	-		1 cfs	2.5 cfs	4.5 cfs	-	-
				20	0.35	1.10	2.12	-	-
6-9045	Chariton River at Novinger	1931-51, 1955-58	[a]1,370		10 cfs	20 cfs	30 cfs	50 cfs	81 cfs
				10	1.57	4.26	7.34	14.5	26.8
				30	2.18	5.55	9.52	18.8	34.7
6-9055	Chariton River near Prairie Hill	1930-58	[a]1,870		20 cfs	50 cfs	80 cfs	100 cfs	167 cfs
				10	1.27	8.13	17.6	24.8	51.6
				30	2.34	11.7	23.8	32.7	64.4
6-9061	Mussel Fork at Keytesville	1942-43, 1946, 1953, 1962-64	-		6.5 cfs	20 cfs	35 cfs	-	-
				20	2.20	8.25	16.1	-	-
6-9064.5	Middle Fork Chariton River near Salisbury	1962-64	-		3 cfs	9 cfs	15 cfs	-	-
				20	1.05	3.75	7.05	-	-

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6-9067	Flat Creek near Sedalia [c]	1960-64	148		3 cfs	9 cfs	15 cfs	-	-
				20	1.04	3.75	6.96	-	-
6-9070	Lamine River at Clifton City	1923-59	598		20 cfs	30 cfs	40 cfs	50 cfs	61 cfs
				10	3.37	6.25	9.32	12.7	16.5
				30	5.35	8.92	13.1	17.1	21.8
6-9075.5	Blackwater River near Warrensburg [d]	1942-43 1946, 1953, 1962-64	-		8 cfs	24 cfs	40 cfs	-	-
				20	2.80	10.0	18.8	-	-
6-9076	Post Oak Creek at Warrensburg [d]	1942-43 1946, 1953, 1962-64	-		2.5 cfs	8 cfs	15 cfs	-	-
				20	0.85	3.40	7.25	-	-
6-9077	Blackwater River at Valley City [c]	1959-64	547		10 cfs	35 cfs	55 cfs	-	-
				20	3.10	14.2	23.8	-	-
6-9078	Davis Creek at Sweet Springs [d]	1942-43, 1945-46, 1953 1962-64	-		4.5 cfs	15 cfs	25 cfs	-	-
				20	1.50	6.20	11.3	-	-

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6-9079	Blackwater River at Sweet Springs	1942-43, 1946, 1952-53, 1962-64	-		20 cfs	60 cfs	80 cfs	-	-
				20	6.80	25.0	33.0	-	-
6-9080	Blackwater River at Blue Lick	1939-59	[a] 1,120		10 cfs	15 cfs	30 cfs	60 cfs	96 cfs
				5	0.83	1.78	5.55	15.3	29.7
				20	2.68	4.36	9.72	21.8	37.7
6-9093.5	Bonne Femme Creek at New Franklin	1962-64	-		2 cfs	6 cfs	10 cfs	-	-
				20	0.60	2.35	4.25	-	-
6-9095	Moniteau Creek near Fayette	1948-59	[a]81		1 cfs	3 cfs	5 cfs	7 cfs	9 cfs
				5	0.28	1.05	1.96	2.97	4.01
				20	0.44	1.43	2.54	3.73	5.00
6-9100	Petite Saline Creek near Boonville	1948-61	182		2 cfs	5 cfs	10 cfs	15 cfs	19 cfs
				5	0.26	1.07	2.82	4.92	6.54
				20	0.63	1.98	4.36	6.78	8.73

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6-9102.2	Perche Creek near Columbia	1962-64	-		5 cfs	15 cfs	25 cfs	-	-
				20	1.60	5.70	10.6	-	-
6-9104.15	Cedar Creek near Cedar City	1962-64	-		4.5 cfs	14 cfs	23 cfs	-	-
				20	1.61	5.75	10.8	-	-
6-9104.2	North Moreau Creek near California	1962-64	-		3 cfs	9 cfs	15 cfs	-	-
				20	0.94	3.60	6.48	-	-
6-9105	Moreau River near Jefferson City	1948-59	531		10 cfs	20 cfs	30 cfs	40 cfs	50 cfs
				5	0.61	2.00	3.67	5.55	7.44
				20	1.78	5.06	8.82	12.7	16.5
6-9166.7	Miami Creek near Butler[d]	1943, 1945, 1947, 1949, 1954-55, 1962-64	-		4 cfs	12 cfs	20 cfs	-	-
				20	1.40	5.00	9.40	-	-

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6-9170.3	Little Osage River at Stotesbury [b,d]	1929-32, 1960, 1962-63	427		8.5 cfs	25 cfs	43 cfs	-	-
				20	3.00	10.7	20.1	-	-
6-9170.6	Little Osage River at Horton	1960-64	-		28 cfs	85 cfs	140 cfs	-	-
				20	9.94	35.5	66.7	-	-
6-9180.8	Osage River near Schell City	1932-35, 1960-64	5,530		110 cfs	330 cfs	550 cfs	-	-
				20	37.5	136	249	-	-
6-9183.2	Clear Creek near Eldorado Springs [d]	1943, 1945, 1946-47, 1949, 1952, 1962-63	-		3 cfs	10 cfs	16 cfs	-	-
				20	1.00	4.50	7.76	-	-
6-9184.2	Sac River at Ash Grove	1962-64	-		12 cfs	25 cfs	-	-	-
				20	0.32	3.25	-	-	-
6-9184.3	Clear Creek near Phenix	1962-64	-		3 cfs	5 cfs	-	-	-
				20	0.12	0.41	-	-	-

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6-9184.5	Limestone Creek at South Greenfield	1962-64	-		2.5 cfs	4 cfs	-	-	-
				20	0.13	0.40	-	-	-
6-9184.7	Turnback Creek near Greenfield	1943, 1945-46, 1949, 1962-64	-		25 cfs	50 cfs	80 cfs	-	-
				20	1.60	9.00	21.0	-	-
6-9190	Sac River near Stockton	1922-58	[a]1,160		30 cfs	50 cfs	70 cfs	80 cfs	92 cfs
				10	1.78	4.56	8.13	10.1	12.5
				30	3.57	8.53	14.5	17.6	21.4
6-9195	Cedar Creek near Pleasant View	1949-61	[a]420		5 cfs	8 cfs	10 cfs	14 cfs	16 cfs
				5	0.50	0.95	1.29	1.96	2.28
				20	1.29	2.22	2.93	4.24	4.96
6-9210	Pomme de Terre River near Bolivar	1951-61	225		5 cfs	8 cfs	10 cfs	20 cfs	28 cfs
				5	-	0.48	0.79	3.37	6.44
				20	0.50	1.41	2.22	6.84	10.9

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6-9215.8	South Grand River near Freeman	1962-64	-		2.5 cfs	7 cfs	12 cfs	-	-
				20	0.86	2.95	5.64	-	-
6-9215.9	South Grand River at Archie[d]	1943, 1945, 1947, 1949, 1952, 1954, 1962-64	-		5.5 cfs	17 cfs	28 cfs	-	-
				20	1.96	7.00	13.2	-	-
6-9216	South Grand River at Urich[c]	1961-64	670		13 cfs	40 cfs	67 cfs	-	-
				20	4.69	16.8	31.5	-	-
6-9217.2	Big Creek at Blairstown[c]	1960-64	414		8 cfs	25 cfs	40 cfs	-	-
				20	2.90	10.4	19.5	-	-
6-9217.8	Deepwater Creek near Montrose[d]	1955, 1962, 1964	-		2 cfs	7 cfs	12 cfs	-	-
				20	0.65	3.00	5.40	-	-
6-9220	South Grand River near Brownington	1922-58	[a]1,660		5 cfs	10 cfs	20 cfs	40 cfs	62 cfs
				10	-	1.33	3.77	9.62	16.9
				30	0.97	2.74	7.14	17.3	29.3

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6-9232	Niangua River near Buffalo	1954, 1962-64	-		13 cfs	20 cfs	-	-	-
				20	0.67	2.10	-	-	-
6-9252.5	Little Niangua River near Macks Creek	1962-64	-		6 cfs	17 cfs	28 cfs	-	-
				20	0.90	4.48	7.28	-	-
6-9254.3	Wet Glaize Creek near Brumley	1962-64	-		25 cfs	35 cfs	-	-	-
				20	2.80	6.55	-	-	-
6-9254.6	Grandglaize Creek near Brumley	1934-36	-		19 cfs	32 cfs	-	-	-
				20	1.02	3.20	-	-	-
6-9260.2	Little Gravois Creek at Bagnell	1931, 1944, 1962-64	-		2.0 cfs	3.5 cfs	-	-	-
				20	0.55	0.91	-	-	-
6-9270	Maries River at Westphalia	1948-61	257		10 cfs	15 cfs	20 cfs	30 cfs	41 cfs
				5	0.91	1.78	2.88	5.35	8.33
				20	2.08	3.61	5.35	8.92	13.3

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
6-9270.5	Middle River near Mokane[d]	1962-64	-		1 cfs	3.5 cfs	6 cfs	-	-
				20	0.25	1.30	2.37	-	-
6-9273	Auxvasse Creek near Steedman	1962-64	-		6 cfs	18 cfs	30 cfs	-	-
				20	2.10	7.50	14.1	-	-
6-9277	Gasconade River near Nebo	1942, 1944-47, 1952, 1962-64	-		38 cfs	64 cfs	-	-	-
				20	3.84	9.60	-	-	-
6-9277.5	Osage Fork near Orla	1953, 1962-64	-		18 cfs	30 cfs	-	-	-
				20	0.69	2.46	-	-	-
6-9278	Osage Fork at Drynob[c]	1942, 1944-47, 1952-53, 1962-64	404		24 cfs	40 cfs	-	-	-
				20	1.29	4.04	-	-	-

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
6-9280	Gasconade River near Hazelgreen	1929-58	[a] 1,250		60 cfs	80 cfs	100 cfs	110 cfs	123 cfs
				10	2.18	5.25	9.92	12.9	17.1
				30	4.07	9.12	15.9	19.8	25.4
6-9284.5	Roubidoux Creek at Waynesville	1942-43, 1945-47, 1952, 1962-64	-		17 cfs	29 cfs	-	-	-
				20	3.48	6.38	-	-	-
6-9285	Gasconade River near Waynesville	1915-58	[a]1,680		100 cfs	125 cfs	150 cfs	170 cfs	180 cfs
				20	3.57	8.53	13.7	17.8	19.8
				50	5.75	11.9	18.2	23.6	25.8
6-9289	Big Piney River near Houston	1942-43, 1945-46, 1949, 1952, 1962-64	-		40 cfs	60 cfs	-	-	-
				20	5.00	12.5	-	-	-
6-9300	Big Piney River near Big Piney	1922-59	[a]560		120 cfs	130 cfs	140 cfs	145 cfs	150 cfs
				10	3.17	5.25	7.93	9.12	10.7
				30	6.35	8.73	11.9	13.7	15.5

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE 1)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
6-9301	Spring Creek at Spring Creek	1961-64	108		25 cfs	35 cfs	-	-	-
				20	1.50	4.70	-	-	-
6-9309	Little Piney Creek at Yancy Mills	1953, 1962-64	-		4 cfs	7 cfs	-	-	-
				20	0.22	0.70	-	-	-
6-9317	Beaver Creek near Newburg	1961-64	-		2 cfs	4 cfs	-	-	-
				20	0.16	0.48	-	-	-
6-9320	Little Piney Creek at Newburg	1929-59	[a]200		35 cfs	40 cfs	42 cfs	44 cfs	47 cfs
				10	-	1.27	1.69	2.18	2.88
				30	0.91	2.28	2.93	3.67	4.96
6-9333	Mill Creek near Newburg	1955-57, 1961-64	-		8 cfs	12 cfs	-	-	-
				20	0.60	2.04	-	-	-
6-9335	Gasconade River at Jerome	1923-61	[a]2,840		400 cfs	460 cfs	500 cfs	530 cfs	545 cfs
				10	4.56	9.92	16.3	22.6	25.8
				30	15.9	28.8	39.7	49.2	53.5

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
6-9340	Gasconade River near Rich Fountain [b]	1922-58	[a]3,180		460 cfs	500 cfs	550 cfs	600 cfs	630 cfs
				10	9.92	15.9	24.2	34.1	40.7
				30	20.2	29.3	41.6	56.5	67.4
6-9355	Loutre River at Mineola	1948-61	202		2 cfs	3 cfs	5 cfs	6 cfs	8 cfs
				5	-	0.40	0.89	1.15	1.71
				20	0.59	0.99	1.78	2.20	3.07
6-9357.3	St. Johns Creek near Washington [d]	1962-63	-		1.5 cfs	5 cfs	8 cfs	- -	- -
				20	0.49	2.00	3.52	-	-
6-9357.5	Femme Osage Creek near Weldon Springs [d]	1961-64	-		1 cfs	3.5 cfs	6 cfs	- -	- -
				20	0.34	1.38	2.52	-	-
7-0104	Meramec River near St. James	1953, 1957 1962-64	-		18 cfs	30 cfs	- -	- -	- -
				20	0.96	3.00	-	-	-

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

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7-0130	Meramec River near Steelville	1923-58	781		120 cfs	130 cfs	140 cfs	150 cfs	177 cfs
				10	2.00	3.57	5.35	7.73	17.4
				30	3.97	6.35	9.72	13.5	24.8
7-0131	Huzzah Creek at Dillard	1943-45, 1961-64	92		20 cfs	30 cfs	-	-	-
				20	1.80	5.00	-	-	-
7-0140	Huzzah Creek near Steelville	1942-43, 1946-47, 1951, 1961-64	-		50 cfs	70 cfs	-	-	-
				20	5.00	12.0	-	-	-
7-0142	Courtois Creek at Berryman	1943-45, 1961-64	173		35 cfs	52 cfs	-	-	-
				20	3.81	10.7	-	-	-
7-0145	Meramec River near Sullivan	1922-32, 1944-58	1,475		250 cfs	275 cfs	300 cfs	325 cfs	341 cfs
				10	6.94	10.9	16.3	23.4	28.8
				30	14.3	20.8	29.7	39.3	47.6

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

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7-0157.5	Bourbeuse River near Owensville	1943, 1946-48, 1962-64	-		7.5 cfs	22 cfs	37 cfs	- -	- -
				20	2.00	8.50	14.8	-	-
7-0157.6	Dry Fork Creek near Owensville	1962-64	-		2 cfs	6 cfs	10 cfs	- -	- -
				20	0.65	2.52	4.52	-	-
7-0160	Bourbeuse River near Spring Bluff	1962-64	608		12 cfs	36 cfs	60 cfs	- -	- -
				20	2.55	12.2	20.7	-	-
7-0165	Bourbeuse River at Union	1922-58	808		30 cfs	50 cfs	75 cfs	90 cfs	106 cfs
				10	1.00	4.16	10.3	15.1	20.2
				30	1.59	5.85	12.9	18.4	24.0
7-0170	Meramec River at Robertsville [b]	1940-50	2,673		350 cfs	450 cfs	500 cfs	520 cfs	540 cfs
				5	3.97	17.8	29.7	35.7	41.6
				20	18.2	49.6	70.4	79.3	89.2

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

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7-0176	Big River near Bonne Terre	1942-43, 1946-47, 1953, 1961-64	-		25 cfs	43 cfs	-	-	-
				20	1.38	4.30	-	-	-
7-0178	Mineral Fork near Potosi	1961-64	-		15 cfs	30 cfs	50 cfs	-	-
				20	0.35	3.20	11.6	-	-
7-0179	Old Mines Creek near Potosi	1961-64	-		1.5 cfs	3 cfs	4.5 cfs	-	-
				20	0.05	0.45	1.06	-	-
7-0180	Big River near DeSoto	1950-61	718		100 cfs	130 cfs	150 cfs	170 cfs	198 cfs
				5	2.58	6.35	10.1	14.7	22.2
				20	7.93	16.9	24.8	33.7	47.2
7-0181	Big River near Richwoods	1942-43, 1946-47, 1951, 1961-64	-		80 cfs	150 cfs	220 cfs	-	-
				20	3.50	22.5	51.0	-	-

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7-0185	Big River at Byrnesville	1923-58	917		75 cfs	100 cfs	125 cfs	175 cfs	227 cfs
				10	0.87	3.17	7.73	20.2	37.7
				30	2.48	7.83	16.3	36.5	60.5
7-0190	Meramec River near Eureka	1922-58	3,788		400 cfs	500 cfs	600 cfs	700 cfs	750 cfs
				10	5.55	18.2	36.7	61.5	74.4
				30	17.8	34.7	59.5	95.2	119
7-0190.5	Joachim Creek at Hematite	1961-64	-		4 cfs	6.5 cfs	- -	- -	- -
				20	0.78	1.43	-	-	-
7-0206	Apple Creek at Appleton	1961-64	-		15 cfs	20 cfs	- -	- -	- -
				20	1.45	4.00	-	-	-
7-0210	Castor River at Zalma	1922-57	423		50 cfs	80 cfs	100 cfs	120 cfs	149 cfs
				10	1.78	8.73	15.1	21.8	31.7
				30	3.57	10.9	17.5	24.8	36.7

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

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7-0211.5	Crooked Creek at Lutesville	1961-64	-		1.5 cfs	4 cfs	7 cfs	- -	- -
				20	0.25	1.10	1.82	-	-
7-0214	Whitewater River at Millersville	1961-64	-		20 cfs	30 cfs	- -	- -	- -
				20	2.00	5.80	-	-	-
7-0216	White water River at Whitewater	1921-26, 1961-64	-		16 cfs	27 cfs	- -	- -	- -
				20	0.86	2.70	-	-	-
7-0340	St. Francis River near Roselle[e]	1939, 1961-64	-		5 cfs	15 cfs	24 cfs	- -	- -
				20	1.22	5.26	9.32	-	-
7-0350	Little St. Francis River at Fredericktown[b]	1939, 1961	-		2 cfs	5.5 cfs	9 cfs	- -	- -
				20	0.50	2.08	3.62	-	-
7-0370	Big Creek at Des Arc	1939, 1961-64	99.6		10 cfs	20 cfs	30 cfs	- -	- -
				20	0.65	3.54	7.85	-	-

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7-0375	St. Francis River near Patterson	1922-57	956		100 cfs	150 cfs	200 cfs	250 cfs	343 cfs
				10	14.9	29.7	50.0	71.4	115
				30	22.2	39.7	61.5	84.3	129
7-0380	Clark Creek at Patterson [e]	1939, 1961-64	37.5		2.2 cfs	3.8 cfs	- -	- -	- -
				20	0.09	0.31	-	-	-
7-0507	James River near Springfield	1956-62	246		15 cfs	25 cfs	- -	- -	- -
				20	2.71	5.41	-	-	-
7-0515	James River below Battlefield [b]	1929-32	328		20 cfs	33 cfs	- -	- -	- -
				20	1.97	4.92	-	-	-
7-0523	Finley Creek near Ozark	1943, 1946-47, 1952, 1962-64	220		13 cfs	22 cfs	- -	- -	- -
				20	0.70	2.20	-	-	-
7-0525	James River at Galena	1922-58	987		60 cfs	80 cfs	90 cfs	100 cfs	119 cfs
				10	0.89	2.78	4.20	5.95	9.52
				30	3.97	7.24	9.22	11.3	15.9

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7-0527.5	Flat Creek at Cassville	1944-46, 1949, 1952, 1956, 1962-64	-		5 cfs	8 cfs	-	-	-
				20	0.38	1.45	-	-	-
7-0528	Flat Creek at Jenkins	1942, 1962-64	-		40 cfs	65 cfs	-	-	-
				20	3.90	14.0	-	-	-
7-0538	Bull Creek at Walnut Shade	1943, 1945-47, 1949, 1952, 1954, 1962-64	-		4 cfs	12 cfs	20 cfs	-	-
				20	0.96	4.20	7.60	-	-
7-0539.8	Swan Creek at Forsyth	1923, 1930-32, 1938, 1941, 1962-64	-		10 cfs	19 cfs	-	-	-
				20	2.08	4.18	-	-	-
7-0541.5	Beaver Creek at Kissee Mills	1943, 1945-46, 1949, 1952, 1962-64	-		40 cfs	80 cfs	120 cfs	-	-
				20	2.70	15.0	31.0	-	-
7-0574	North Fork River at Twin Bridges	1962-64	-		40 cfs	55 cfs	-	-	-
				20	2.20	6.80	-	-	-

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7-0574.5	Spring Creek at Twin Bridges	1962-64	-		25 cfs	35 cfs	-	-	-
				20	1.65	4.95	-	-	-
7-0575	North Fork River near Tecumseh	1945-61	561		250 cfs	260 cfs	280 cfs	290 cfs	299 cfs
				5	-	3.57	6.54	8.53	10.3
				20	5.95	8.13	13.1	15.9	18.2
7-0580	Bryant Creek near Tecumseh	1945-61	570		130 cfs	135 cfs	140 cfs	145 cfs	149 cfs
				5	-	-	1.43	2.38	2.97
				20	5.55	7.14	8.92	10.7	11.9
7-0611.5	West Fork Black River at Centerville	1942-43, 1945-47, 1952, 1960-64	-		25 cfs	40 cfs	-	-	-
				20	0.70	5.67	-	-	-
7-0611.7	Middle Fork Black River near Lesterville	1960-64	-		15 cfs	30 cfs	50 cfs	-	-
				20	0.25	3.40	12.0	-	-

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7-0613	East Fork Black River at Lesterville [c]	1960-64	94.5		5.7 cfs	9.4 cfs	-	-	-
				20	1.04	2.08	-	-	-
7-0615	Black River near Annapolis	1940-57	484		120 cfs	150 cfs	200 cfs	220 cfs	244 cfs
				5	3.97	9.52	23.8	30.7	39.7
				20	10.3	20.8	41.6	50.0	60.5
7-0619	Logan Creek at Ellington	1956-57, 1962-64	-		2.4 cfs	7.2 cfs	12 cfs	-	-
				20	0.38	1.92	3.36	-	-
7-0621	McKinzie Creek near Piedmont	1960-64	-		3 cfs	6 cfs	9 cfs	-	-
				20	0.15	0.96	2.22	-	-
7-0635	Cane Creek at Harviell [e]	1939-42, 1958-61, 1963-64	188		10 cfs	19 cfs	-	-	-
				20	1.12	2.82	-	-	-

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7-0648	Sinking Creek near Round Spring	1942-43, 1945-47, 1952, 1956, 1962-64	-		30 cfs	42 cfs	-	-	-
				20	0.70	3.50	-	-	-
7-0652	Jacks Fork near Mountain View	1942-43, 1945-46, 1952, 1962-64	-		20 cfs	35 cfs	50 cfs	-	-
				20	1.00	4.55	10.5	-	-
7-0660	Jacks Fork at Eminence	1922-59	398		110 cfs	120 cfs	130 cfs	140 cfs	154 cfs
				10	2.38	4.76	7.63	10.7	15.3
				30	6.15	8.73	11.9	15.5	21.4
7-0665	Current River near Eminence	1922-59	1,272		450 cfs	480 cfs	500 cfs	530 cfs	567 cfs
				10	5.95	11.3	15.3	22.8	34.7
				30	17.1	26.2	32.7	43.6	55.5
7-0670	Current River at Van Buren	1922-59	1,667		600 cfs	650 cfs	700 cfs	750 cfs	800 cfs
				10	5.95	13.9	24.8	38.1	56.7
				30	19.8	33.7	49.6	69.4	95.5

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7-0680	Current River at Doniphan	1922-59	2,038		1000 cfs	1100 cfs	1200 cfs	1250 cfs	1330 cfs
				10	-	25.8	49.6	63.5	91.2
				30	16.3	43.6	75.4	93.2	127
7-0685	Little Black River near Fairdealing [e]	1939-42, 1962-64	187		20 cfs	35 cfs	55 cfs	- -	- -
				20	0.50	4.00	11.8	-	-
7-0691.5	Spring River at Thayer	1954, 1962-64	-		4 cfs	10 cfs	19 cfs	- -	- -
				20	0.61	3.04	5.32	-	-
7-0704.5	Eleven Point River at Thomasville	1942-43, 1945-46 1951, 1962-64	-		7 cfs	20 cfs	- -	- -	- -
				20	2.45	8.75	-	-	-
7-0705	Eleven Point River near Thomasville	1951-61	361		10 cfs	12 cfs	15 cfs	20 cfs	26 cfs
				5	0.59	1.01	1.76	3.27	5.37
				20	0.99	1.65	2.78	5.06	7.93

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STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
7-0715	Eleven Point River near Bardley	1922-59	793		200 cfs	250 cfs	270 cfs	290 cfs	310 cfs
				10	-	10.3	16.3	23.8	32.7
				30	4.76	20.6	28.2	37.3	45.6
7-1854	Williams Creek near Mount Vernon	1954, 1962-64	-		4 cfs	6 cfs	- -	- -	- -
				20	0.22	1.50	-	-	-
7-1856.5	Spring River near Stotts City	1962-64	-		40 cfs	70 cfs	- -	- -	- -
				20	2.50	27.0	-	-	-
7-1857	Spring River at Larussell [c]	1957-64	306		60 cfs	70 cfs	- -	- -	- -
				20	12.5	20.8	-	-	-
7-1857.5	White Oak Creek near Avilla [d]	1954, 1962-64	-		0.8 cfs	2.5 cfs	4 cfs	- -	- -
				20	0.28	1.00	1.88	-	-

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
7-1858	Spring River near Neck City[d]	1954, 1962-64	-		60 cfs	70 cfs	- -	- -	- -
				20	9.00	14.5	-	-	-
7-1858.5	North Fork Spring River at Lamar[d]	1943, 1946, 1962-63	-		2.5 cfs	7 cfs	12 cfs	- -	- -
				20	0.84	3.00	5.64	-	-
7-1860	Spring River near Waco	1925-62	1,164		30 cfs	40 cfs	50 cfs	55 cfs	61 cfs
				10	0.42	1.19	2.58	3.47	4.56
				30	2.58	4.66	7.34	8.82	10.7
7-1861	Center Creek near Sarcoxie	1954, 1962-64	-		18 cfs	27 cfs	- -	- -	- -
				20	2.48	9.90	-	-	-
7-1862	Center Creek near Fidelity	1962-64	-		20 cfs	40 cfs	- -	- -	- -
				20	1.38	13.8	-	-	-

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
7-1864	Center Creek near Carterville c	1962-64	232		25 cfs	45 cfs	- -	- -	- -
				20	3.75	17.2	-	-	-
7-1864.2	Center Creek near Webb City d	1962-64	-		50 cfs	75 cfs	- -	- -	- -
				20	12.3	36.2	-	-	-
7-1864.6	Center Creek near Carl Junction	1943, 1946, 1949, 1952, 1954, 1956, 1962-64	-		55 cfs	80 cfs	- -	- -	- -
				20	13.8	37.2	-	-	-
7-1867	Shoal Creek near Fairview	1954, 1962-64	-		15 cfs	22 cfs	- -	- -	- -
				20	1.02	6.00	-	-	-
7-1868	Capps Creek near Berwick	1962-64	-		12 cfs	- -	- -	- -	- -
				20	0.40	-	-	-	-
7-1868.5	Clear Creek near Ritchey	1954, 1962-64	-		7.5 cfs	- -	- -	- -	- -
				20	1.40	-	-	-	-

DRAFT-STORAGE-FREQUENCY DATA AT CONTINUOUS-RECORD AND PARTIAL-RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE 1)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
7-1868.8	Shoal Creek at Ritchey	1954, 1962-64	-		57 cfs	-	-	-	-
				20	10.7	-	-	-	-
7-1868.9	Shoal Creek at Neosho	1941-43, 1945-46, 1949, 1952, 1954, 1962-64	-		60 cfs	70 cfs	-	-	-
				20	5.70	10.5	-	-	-
7-1869	Hickory Creek at Neosho	1941, 1962-64	-		9 cfs	-	-	-	-
				20	1.28	-	-	-	-
7-1870	Shoal Creek above Joplin	1942-62	410		50 cfs	55 cfs	60 cfs	70 cfs	78 cfs
				10	0.40	0.71	1.19	2.60	4.36
				30	4.16	6.05	7.73	11.5	14.5
7-1888.5	Elk River at Pineville	1942, 1945, 1947, 1949, 1952, 1962-64	-		30 cfs	49 cfs	-	-	-
				20	5.5	14.7	-	-	-
7-1888.7	Indian Creek at Anderson	1942, 1945, 1947, 1949, 1952, 1962-64	-		40 cfs	60 cfs	-	-	-
				20	5.50	22.0	-	-	-

DRAFT - STORAGE - FREQUENCY DATA AT CONTINUOUS - RECORD AND PARTIAL - RECORD STATIONS IN MISSOURI

STATION NUMBER (PLATE I)	STATION NAME	RECORD USED IN ANALYSIS	DRAINAGE AREA (SQUARE MILES)	RECURRENCE INTERVAL (YEARS)	AMOUNT OF STORAGE (IN THOUSANDS OF ACRE-FEET) FOR DRAFT RATE (IN CFS) INDICATED IN COLUMN HEADINGS (NOT CORRECTED FOR RESERVOIR EVAPORATION, SEDIMENTATION, AND SEEPAGE)				
7-1890	Elk River near Tiff City	1940-61	872		40 cfs	60 cfs	90 cfs	120 cfs	135 cfs
				5	-	0.71	3.97	10.7	15.1
				20	3.57	8.53	17.8	27.8	33.3
7-1891	Buffalo Creek at Tiff City[d]	1954, 1962-64	-		1.8 cfs	5.5 cfs	9 cfs	- -	- -
				20	0.72	3.60	6.30	-	-

a - Approximately

b - Discontinued continuous-record station

c - Continuous-record station which was treated as partial-record station because of scant data

d - Discontinued partial-record station

e - Discontinued continuous-record station currently operated as partial-record station

INDEX OF STATION NAMES

(*Indicates Continuous-record Station)

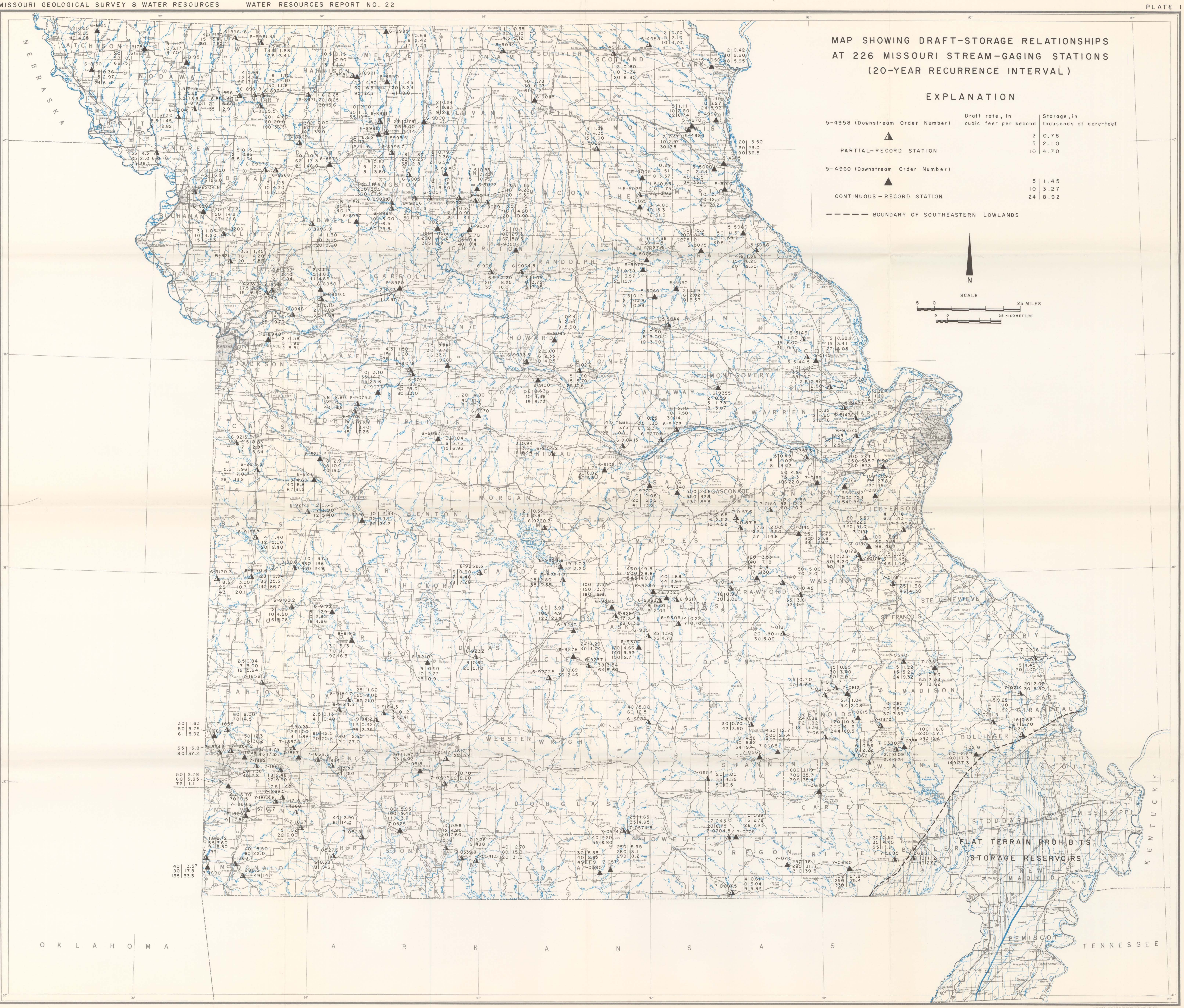
Clark Creek at Patterson	7-0380
Clear Creek near Eldorado Springs	6-9183.2
Clear Creek near Phenix	6-9184.3
Clear Creek near Ritchey	7-1868.5
Chariton River at Novinger*	6-9045
Chariton River near Prairie Hill*	6-9055
Courtois Creek at Berryman	7-0142
Crooked Creek at Lutesville	7-0211.5
Crooked River near Richmond*	6-8950
Cuivre River near Troy*	5-5145
Current River at Doniphan*	7-0680
Current River at Van Buren*	7-0670
Current River near Eminence*	7-0665
Dardenne Creek near Weldon Spring	5-5147.2
Davis Creek at Sweet Springs	6-9078
Deepwater Creek near Montrose	6-9217.8
Dry Fork Creek near Owensville	7-0157.6
East Fork Black River at Lesterville*	7-0613
East Fork Grand River at Albany	6-8964
East Yellow Creek near Brookfield	6-9029
Eleven Point River at Thomasville	7-0704.5
Eleven Point River near Bardley*	7-0715
Eleven Point River near Thomasville*	7-0705
Elk Fork Salt River near Paris*	5-5070
Elk River at Pineville	7-1888.5
Elk River near Tiff City*	7-1890
Femme Osage Creek near Weldon Springs	6-9357.5
Finley Creek near Ozark	7-0523
Fishing River at Mosby	6-8943
Fishing River near Orrick	6-8946
Flat Creek at Cassville	7-0527.5
Flat Creek at Jenkins	7-0528
Flat Creek near Sedalia*	6-9067
Fox River at Wayland*	5-4950
Gasconade River at Jerome*	6-9335
Gasconade River near Hazelgreen	6-9280
Gasconade River near Nebo	6-9277
Gasconade River near Rich Fountain*	6-9340
Gasconade River near Waynesville*	6-9285
Grand River at Chillicothe	6-8996.8
Grand River near Darlington	6-8965.5
Grand River near Gallatin*	6-8975
Grand River near Grant City	6-8961.6

Grand River near Pattonsburg	6-8969
Grand River near Stanberry	6-8961.7
Grand River near Sumner*	6-9020
Grandglaize Creek near Brumley	6-9254.6
Hickory Creek at Neosho	7-1869
Honey Creek near Trenton	6-8995.7
Huzzah Creek at Dillard	7-0131
Huzzah Creek near Steelville	7-0140
Indian Creek at Anderson	7-1888.7
Jacks Fork at Eminence*	7-0660
Jacks Fork near Mountain View	7-0652
James River at Galena*	7-0525
James River below Battlefield	7-0515
James River near Springfield	7-0507
Joachim Creek at Hematite	7-0190.5
Lamine River at Clifton City*	6-9070
Limestone Creek at South Greenfield	6-9184.5
Little Black River near Fairdealing	7-0685
Little Blue River near Lake City*	6-8940
Little Gravois Creek at Bagnell	6-9260.2
Little Niangua River near Macks Creek	6-9252.5
Little Osage River at Horton	6-9170.6
Little Osage River at Stotesbury	6-9170.3
Little Piney Creek at Newburg*	6-9320
Little Piney Creek at Yancy Mills	6-9309
Little Platte River near Trimble	6-8211
Little St. Francis River at Fredericktown*	7-0350
Locust Creek near Linneus	6-9015
Logan Creek at Ellington	7-0619
Long Creek near Guilford	6-8190.1
Lost Creek near Weatherby	6-8968
Loutre River at Mineola*	6-9355
Maries River at Westphalia*	6-9270
McKinzie Creek near Piedmont	7-0621
Medicine Creek near Galt	6-9000
Medicine Creek near Sturges	6-9005
Medicine Creek near Wheeling	6-9006
Meramec River at Robertsville*	7-0170
Meramec River near Eureka*	7-0190
Meramec River near St. James	7-0104
Meramec River near Steelville*	7-0130
Meramec River near Sullivan*	7-0145
Miami Creek near Butler	6-9166.7

Middle Fabius River near Monticello*	5-4980
Middle Fork Black River near Lesterville	7-0611.7
Middle Fork Chariton River near Salisbury	6-9064.5
Middle Fork Grand River at Grant City	6-8961.85
Middle Fork Grand River near Albany	6-8961.9
Middle Fork Salt River at Paris*	5-5065
Middle River near Mokane	6-9270.5
Mill Creek near Newburg	6-9333
Mineral Fork near Potosi	7-0178
Moniteau Creek near Fayette*	6-9095
Moreau River near Jefferson City*	6-9105
Muddy Creek at Trenton	6-8995.5
Mussel Fork at Keytesville	6-9061
Niangua River near Buffalo	6-9232
Nodaway River near Burlington Junction*	6-8175
Nodaway River near Oregon	6-8178
North Fabius River at Memphis	5-4969.5
North Fabius River at Monticello*	5-4970
North Fabius River at Taylor*	5-4985
North Fork Cuivre River at Silex	5-5143
North Fork River near Tecumseh*	7-0575
North Fork River at Twin Bridges	7-0574
North Fork Spring River at Lamar	7-1858.5
North Moreau Creek near California	6-9104.2
North River at Bethel*	5-5005
North River at Palmyra*	5-5010
North Wyaconda River near Granger	5-4958
Old Mines Creek near Potosi	7-0179
102 River near Maryville*	6-8195
102 River near St. Joseph	6-8204.8
Osage Fork at Drynob*	6-9278
Osage Fork near Orla	6-9277.5
Osage River near Schell City	6-9180.8
Panther Creek at Mt. Moriah	6-8981.1
Parson Creek at Meadville	6-9007
Perche Creek near Columbia	6-9102.2
Peruque Creek near Wentzville	5-5147.1
Petite Saline Creek near Boonville*	6-9100
Platte River near Agency*	6-8205
Pomme de Terre River near Bolivar*	6-9210
Post Oak Creek at Warrensburg	6-9076
Roubidoux Creek at Waynesville	6-9284.5
Sac River at Ash Grove	6-9184.2
Sac River near Stockton*	6-9190

St. Francis River near Patterson*	7-0375
St. Francis River near Roselle	7-0340
St. Johns Creek near Washington	6-9357.3
Salt River near Monroe City*	5-5075
Salt River near New London*	5-5080
Salt River near Novelty	5-5022
Salt River near Shelbina*	5-5025
Shoal Creek above Joplin*	7-1870
Shoal Creek at Kingston	6-8996.9
Shoal Creek at Neosho	7-1868.9
Shoal Creek at Ritchey	7-1868.8
Shoal Creek near Braymer*	6-8997
Shoal Creek near Chillicothe	6-8998
Shoal Creek near Fairview	7-1867
Sinking Creek near Round Spring	7-0648
South Fabius River near Taylor*	5-5000
South Fork Salt River at Mexico	5-5044
South Fork Salt River at Santa Fe*	5-5050
South Grand River at Archie	6-9215.9
South Grand River at Urich*	6-9216
South Grand River near Brownington*	6-9220
South Grand River near Freeman	6-9215.8
Spencer Creek near Frankford	5-5088
Spring Creek at Spring Creek	6-9301
Spring Creek at Twin Bridges	7-0574.5
Spring River at Larussell*	7-1857
Spring River at Thayer	7-0691.5
Spring River near Neck City	7-1858
Spring River near Stotts City	7-1856.5
Spring River near Waco*	7-1860
Swan Creek at Forsyth	7-0539.8
Tarkio River at Fairfax	6-8130
Thompson River at Trenton	6-8995
Thompson River at Mt. Moriah*	6-8981
Turkey Creek near Laclede	6-9031
Turnback Creek near Greenfield	6-9184.7
Wakenda Creek at Carrollton*	6-8960
Weldon River at Mill Grove*	6-8990
Weldon River near Mercer*	6-8985
Weldon River near Trenton	6-8991
West Fork Black River at Centerville	7-0611.5
West Fork Crooked River at Richmond	6-8950.5
West Fork Cuivre River near Troy	5-5144.5

West Fork Lost Creek at Maysville	6-8967.5
West Tarkio Creek near Westboro*	6-8125
West Yellow Creek below Brookfield	6-9023
West Yellow Creek near Brookfield*	6-9022
Wet Glaize Creek near Brumley	6-9254.3
White Cloud Creek near Barnard	6-8204
White Oak Creek near Avilla	7-1857.5
Whitewater River at Millersville	7-0214
Whitewater River at Whitewater	7-0216
Williams Creek near Mosby	6-8944
Williams Creek near Mt. Vernon	7-0185.4
Wyaconda River above Canton*	5-4960
Yellow Creek near Rothville	6-9030
Youngs Creek near Mexico*	5-5060


MAP SHOWING DRAFT-STORAGE RELATIONSHIPS
AT 226 MISSOURI STREAM-GAGING STATIONS
(20-YEAR RECURRENCE INTERVAL)
EXPLANATION
5-4958 (Downstream Order Number)
Draft rate, in cubic feet per second
Storage, in thousands of acre-feet
2 | 0.78
5 | 2.10
10 | 4.70
PARTIAL-RECORD STATION
5-4960 (Downstream Order Number)
5 | 1.45
10 | 3.27
24 | 8.92
CONTINUOUS-RECORD STATION
BOUNDARY OF SOUTHEASTERN LOWLANDS
N
SCALE
25 MILES
25 KILOMETERS
FLAT TERRAIN PROHIBITS
STORAGE RESERVOIRS
NEBRASKA
OKLAHOMA
ARKANSAS
TENNESSEE
KENTUCKY